INTERAVIA

WORLD REVIEW OF AVIATION AND ASTRONAUTICS

Price of this issue —

U.S.A.:	$ 1.00
British Isles:	4/6
South Africa:	6s.
Rhodesia:	6/6
Switzerland:	Fr. 3.50
Germany:	DM 3.50
Denmark:	Cr. 6.25
France:	Fr. 400
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Netherlands:	Fl. 2.80
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Tupolev 114 Rossiya

Interavia Competition: Prize-Winning Essays

VOLUME XIV

No 8/1959

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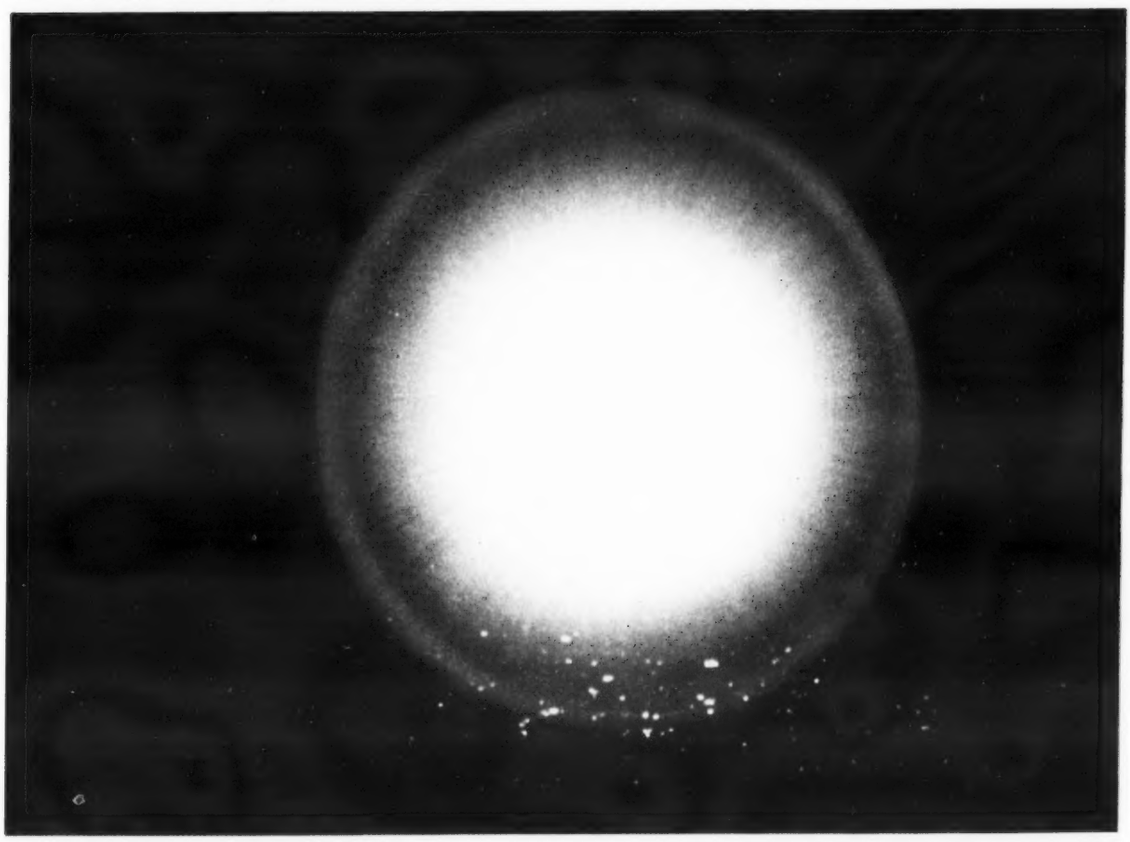
The sun appears to wear a crystalline halo—a sight you may see on a cold day in the stratosphere, kingdom of the DC-8.



Volume XIV

INTERAVIA

August 1959

WORLD REVIEW OF AVIATION AND ASTRONAUTICS

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Front cover : The Jubilee Air Show—General view of the exhibition halls and the static park at the 14-nation air and space show.

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Distributors :

Austria	Morawa & Co., Wollzeile 11, Vienna I
Canada	Wm. Dawson Subscription Service Ltd., 587 Mount Pleasant Road, Toronto 12, Ont.
	Edward Company Regd., P.O. Box 98, Station Delorimier, Montreal P.Q.
Eire	Basil Clancy, Cooleevin, Foxrock, Co. Dublin
Finland	Akateeminen Kirjakauppa, Keskuskatu 2, Helsinki
	Rautatiekirjakauppa Oy, Köjdenpunojank 2, Helsinki
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Great Britain	W. H. Smith & Son, Ltd., Strand House, Portugal Street, London, W.C. 2
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Japan	Maruzen Co. Ltd., 6 Tori-Nichome Nihonbashi, Tokyo
Norway	A/S Narvesens Litteraturtjeneste, Postboks 115, Oslo
Uruguay	Humanitas, Colonia 883, Montevideo

Advertising Department, Publishing and Editorial Offices, Subscription Department :

Interavia S.A., 6, Corraterie, Geneva. Telephone: 25 42 34 (five lines). Cables and Telegrams: Interavia-Geneva. Teleprinter: 22 122. Postal Cheque Account: Geneva I 5380.

Annual Subscriptions : U.S.A. and Canada, U.S.$ 9.00; United Kingdom and Eire £2.12.6; Commonwealth, £2.12.6; Switzerland, 32.— fr.; Austria, 190.— sch.; Belgium, 370.— fr.; Denmark, 55.— kr.; France, 4200 fr.; Germany, 32.— DM; Holland, 28.— fl.; Italy, 4640.— L. it.; Japan, U.S. $9.00; Latin American countries, U.S. $9.00; Norway, 57.— kr.; Spain, 450.— pts.; Sweden, 40.— kr. All other countries, U.S. $9.00.

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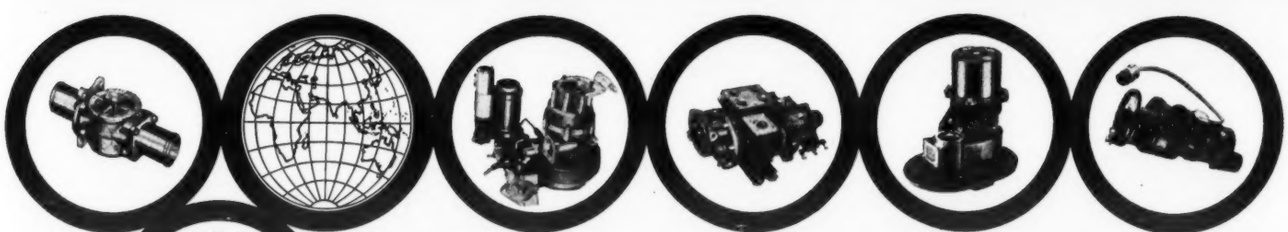

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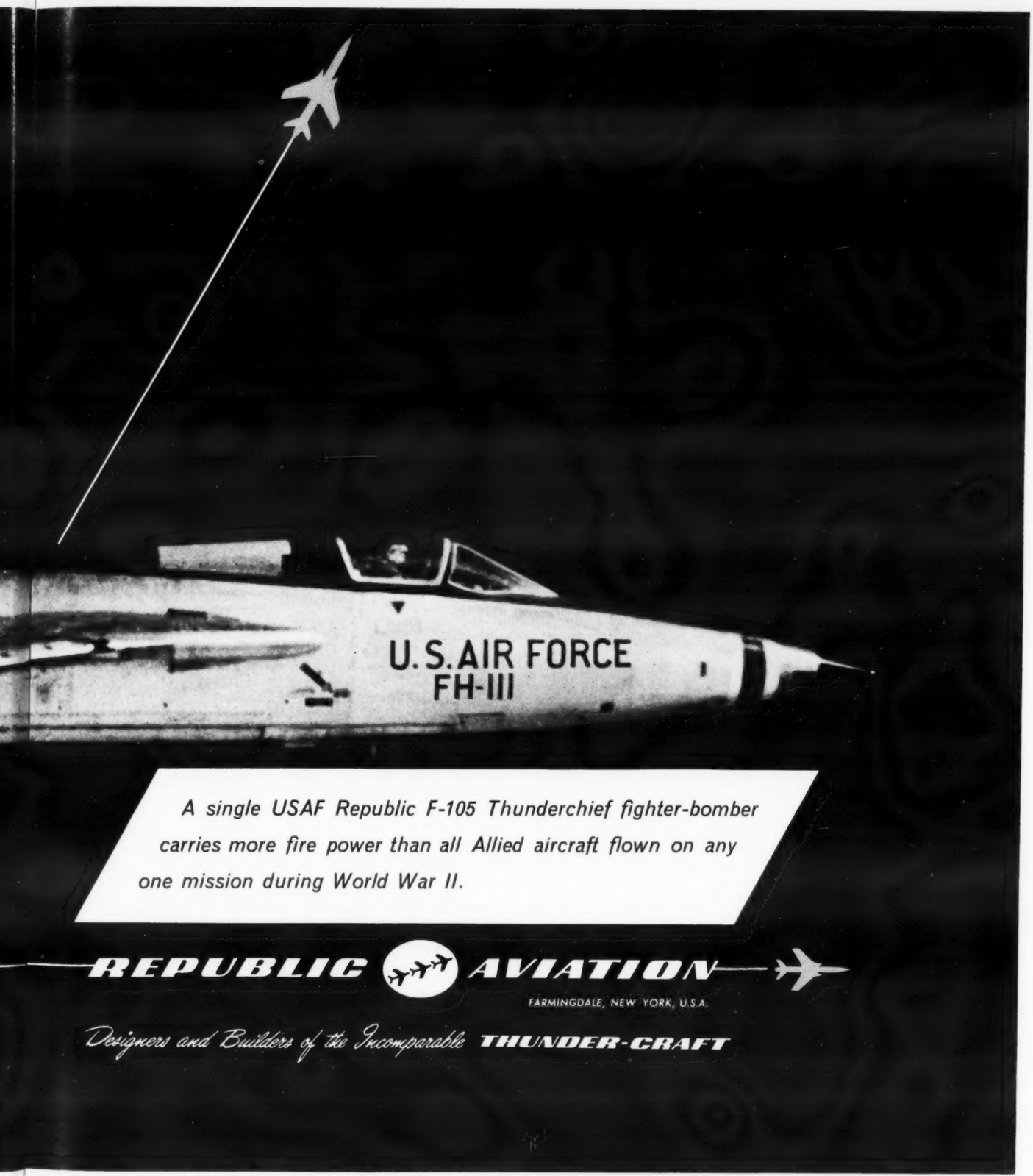
F-105 THUNDERCHIEF



A single USAF Republic F-105 Thunderchief fighter-bomber carries more fire power than all Allied aircraft flown on any one mission during World War II.

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CONVERSION AND OVERHAUL: Douglas DC-6 aircraft.
LICENCE CONSTRUCTION: Hawker Hunter Mk 4 and Mk 6.
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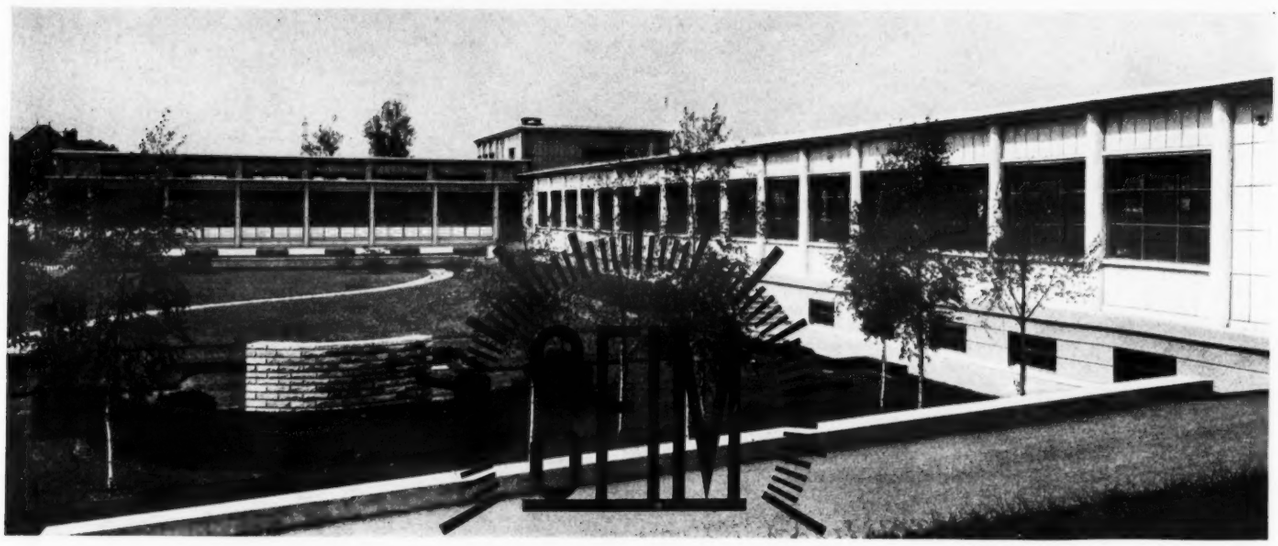

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SFIM (Société de Fabrication d'Instruments de Mesure) was founded in 1947 under the sponsorship of the Brétigny Flight Test Centre with the aim of procuring vital flight test equipment for government engineers. This led to the creation of measuring instruments and photographic equipment for recording flight parameters, allowing aircraft performance to be monitored.

Since 1952 the technical success of these instruments has enabled SFIM to design airborne equipment such as electrical horizons, gyromagnetic compasses, oxygen regulators and ADFs.

This new, steadily growing branch is now embarking on the manufacture under BEZU licence of the C.V.151 twin-gyroscope flight director, a key instrument in the Mirage III's weapons system.

Parallel with this, SFIM's research and development division has turned its energies to solving new problems in the navigation, pilotage and stabilization of helicopters, fixed-wing aircraft and missiles. Noteworthy developments are floating integrating gyroscopes for inertial navigation, high-sensitivity miniaturized gyrometers for measuring angular velocity, and transmitter/receiver systems for telemetering aircraft or missile flight parameters.

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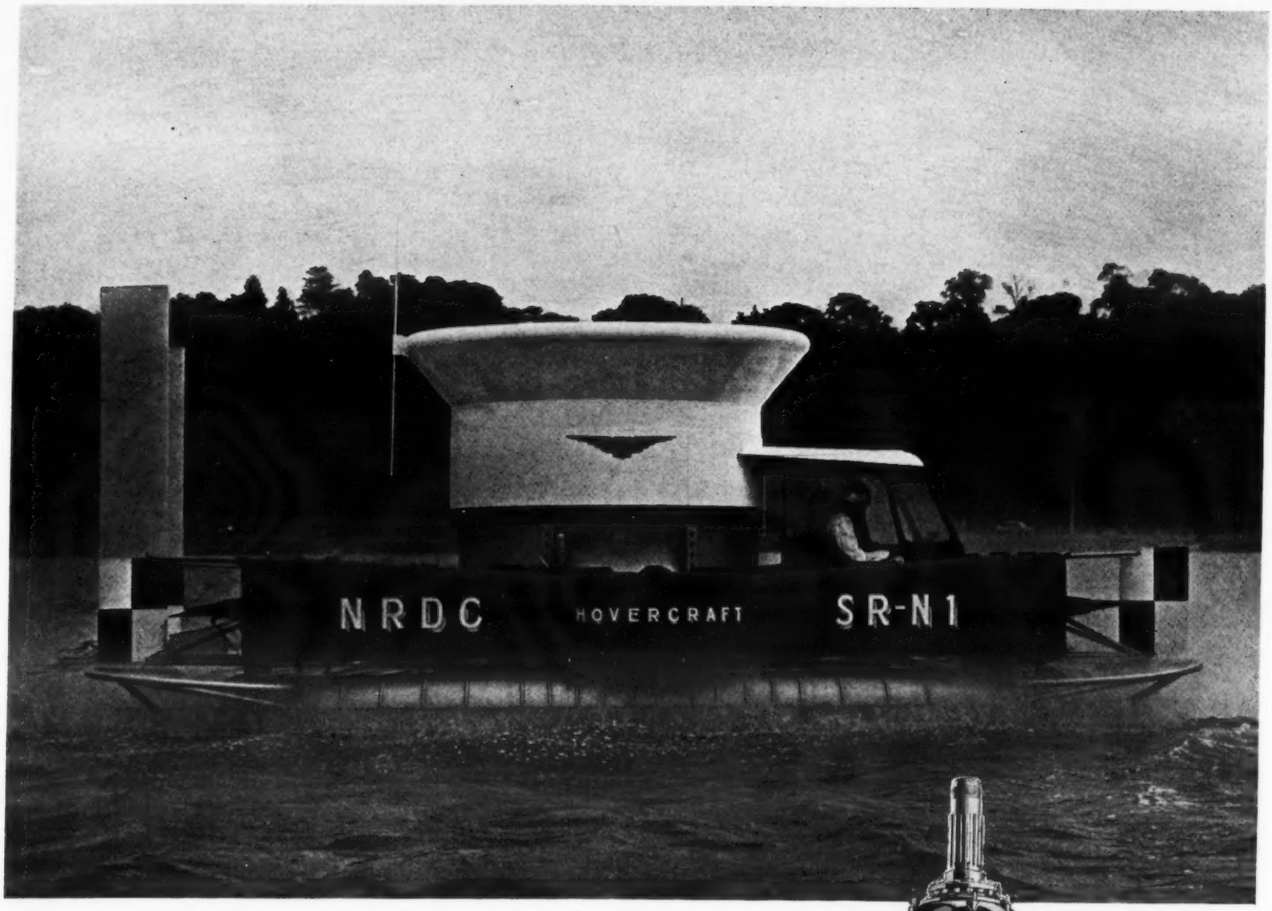
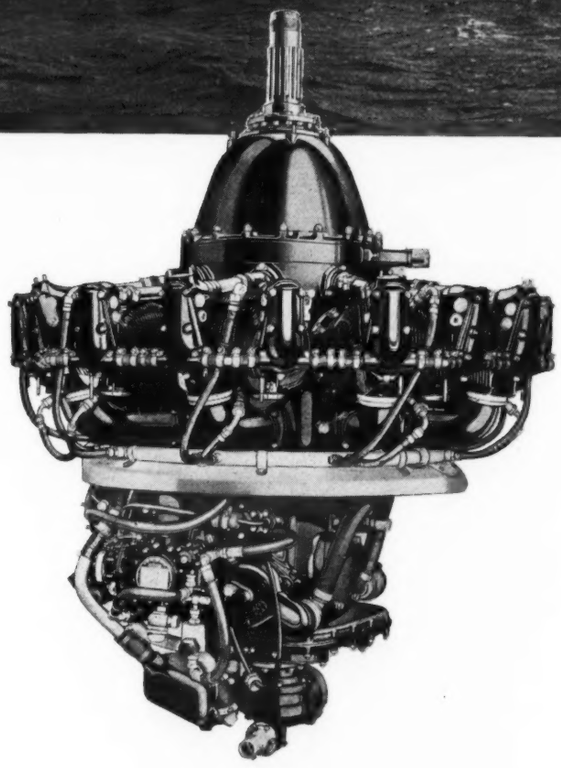


POWER FOR THE HOVERCRAFT...

The Alvis Leonides Engine which has been extensively developed for fixed wing and helicopter application has been chosen to power the new Hovercraft, designed by Mr. Cockerell and built by Saunders-Roe.



ALVIS LEONIDES AERO ENGINES

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Deadline Notes

Westland Aircraft Ltd. has taken over Saunders-Roe Ltd. for a cash payment of £100,000 and 3,200,000 newly-issued five-shilling Westland shares. The merger makes Westland the largest helicopter manufacturer outside the United States, with seven different types in production or development, including the Saro Skeeter and naval P.531. Saunders-Roe has been hard hit since the cancellation of the SR.177 rocket-plus-jet fighter, and its only recent development has been the construction of the N.1 hovercraft under contract to the National Research and Development Corporation. Whether the hovercraft work will now continue at Cowes is still under discussion. It is understood that several bids to take over this work have been made by other large British companies. Saunders-Roe's two main subsidiaries, Saunders-Roe (Anglesey) and Saro Laminated Wood Products, have been acquired by de Havilland Holdings Ltd.

●

Fairey Aviation Ltd. and the British Government are negotiating concerning the development and production of the *Rotodyne* VTOL transport for military use. It is more than probable that enough research and development money will be found to place a fairly large production order for the *Tyne-Rotodyne* within a matter of weeks. Meanwhile, BEA is expected to place an order for six machines. With the orders already received from New York Airways and Okanagan Helicopters, the company should thus be able to lay down a line for 50 *Rotodynes* straight away.

●

The Indian Government has signed an agreement with Hawker Siddeley Aviation Ltd. for licence production of the twin-turboprop Avro 748 in India ; the Avro 748 will be utilized by the Indian Air Force as a DC-3 replacement. Agency reports indicate that the value of the contract is in the order of £20,000,000 to £25,000,000 and involves a total of some 100 aircraft.

●

United Aircraft Corporation is to embark upon a $68,000,000 development programme to expand its missile and space system production. All four operating divisions—Pratt & Whitney, Sikorsky, Hamilton Standard and Norden—as well as the research division at East Hartford and the research plant at Menlo Park, California, are involved. Out of the total, £39 million is being allotted for research and development, and $29 million for production. The company reports that since 1946 it has spent some $275 million of its own funds for new production and experimental facilities.

●

The 75th Lockheed Electra rolled off the production line on July 7th and will be delivered to Western Air Lines in August. The 100th *Electra*, an international model for Qantas Empire Airways, is well along in assembly and is scheduled for completion in October. A total of 62 *Electras* has already been delivered to various airlines.

●

Douglas Aircraft Company has announced that the average cost of DC-8 jet airliners ordered after August 15th will be increased by up to 10 percent. So far 18 airlines have ordered the DC-8 at an average price of $5 million per aircraft. The company said that the increase reflected the rising cost of production resulting from higher labour and materials costs.

●

The Bundesverband der Deutschen Luftfahrtindustrie (Association of Federal German Aircraft Manufacturers) revealed the following details at its Annual General Meeting in Bad Godesberg : The airframe industry in the Federal Republic employs about 12,000 persons, including 2,200 engineers and technicians. The manufacture of engines at present employs 1,000 persons, including 200 engineers and technicians. The equipment industry occupies between 6,000 and 7,000 personnel on orders from aircraft manufacturers. Federal Defence Minister Strauss emphasized that the German aircraft industry should be kept within reasonable limits. The time for a purely national effort was past, and the extent and tasks of future German production should be determined with respect to Germany's political and military alliances.

●

The British Government is to take a firm stand with IATA over reducing fares in Europe and the Near and Far East. This was re-emphasized in a speech made in the House of Commons in mid-July by Minister of Transport and Civil Aviation Harold Watkinson. It is certain that on colonial routes and routes where IATA is not concerned, a new British low-fare policy will be put into operation. Lower fares would greatly benefit airlines operating turboprop and piston-engine aircraft. Talks are in progress with Australia, India and Canada with a view to a Commonwealth airline and aircraft procurement policy.

●

British European Airways' Chairman, Lord Douglas of Kirtleside, has announced that on June 25th BEA carried its 20 millionth passenger since the carrier was established almost 13 years ago. The 10 million mark was reached after nine years operating.

●

Howard Hughes, whose Hughes Tool Company owns a 78 percent holding in Trans World Airlines, intends to sell six Boeing 707-331s, originally ordered for TWA, to Pan American World Airways for $40 million. This is to ease TWA's financial situation which, in spite of the favourable balance earlier recorded, now shows outstanding debts to the value of $320 million for the purchase of 63 jet airliners. At the same time Hughes has an option to take over six PAA Boeing 707-121s costing between $32 and $33 million, which will be bought if the necessary finances are available at a later date.

●

American Airlines is to modify its fleet of 50 Boeing 707s (twenty-five 707-120s and twenty-five 720s) from conventional Pratt & Whitney turbojet powerplants to P&W's new turbofan engines. The conversion programme is scheduled to begin next year when the new P&W units become available, and American's 707s with the new powerplants will be in scheduled service in substantial numbers during the first quarter of 1961. Thirty-five of the aircraft will be delivered to American before the turbofan is available and will be modified at a later date; the remaining fifteen will be delivered with the turbofan engine installed.

On July 12th American inaugurated a non-stop Boeing 707 service between New York City and Dallas, Texas. The new flight makes the 1,384-mile trip in three hours fifteen minutes. Since American inaugurated domestic jet services on January 25th this year, its Boeing 707s have carried some 150,000 passengers and enjoyed overall load factors well in excess of 90 percent.

●

KLM, Royal Dutch Airlines has issued 50 million guilders (approx. $13,200,000) worth of 4 ¾% debentures repayable within twenty years to help finance the purchase of Lockheed *Electras* and Douglas DC-8s. Total value of the aircraft on order is 400 million guilders ($105,600,000). The new debentures are in addition to a medium-term American bank credit of $70 million and a 4 ¾% twenty-year convertible loan of $18.5 million issued in March.

●

LOT, Polskie Linie Lotnicze, the Polish State airline, is studying both *Viscounts* and *Eland*-powered Convair 540s to replace its present equipment. Both Vickers and Napier have done route analyses for the company.

In 1958 LOT served eight Polish and sixteen foreign cities in fifteen European countries. On January 1st, 1959 its route network was 7,752 miles, of which foreign routes accounted for 6,630 miles. In 1958 LOT carried a total of 40,121 passengers.

●

East Germany's Lufthansa, established in 1954, has a capital of DM (East) 100 million ; shareholders are the East German Government and various East European State airlines. Due to a shortage of aircrews and aircraft, regular scheduled services were not opened until 1956. Today 90 flights are operated weekly from Berlin-Schönefeld : 20 to Moscow, 21 to Prague, 10 to Warsaw, 6 each to Bucharest and Sofia, and the balance on domestic services. Load factor on foreign services is reported to be in the region of 40 percent. The East German Lufthansa carried more than 200,000 passengers during 1958.

Because the East German Lufthansa is not accepted in countries outside the Eastern *bloc*, a new company, Interflug, was established early in 1959, with a capital of DM (East) 80 million subscribed by the Association of People's Aircraft Factories, Dresden, the East German Transport Ministry and the State forwarding agency Deutrans. Interflug has operated into the West, however, only on the occasion of the Leipzig Spring Fair (Leipzig-Copenhagen services) and, more recently, to Geneva for the Foreign Ministers's Conference.

●

Civil Air Transport, of Taipei, Formosa, has ordered a Convair 880 jet airliner. The 88-passenger intercontinental aircraft, to be known as the "Mandarin Jet", will be delivered to CAT in November 1960.

●

The German companies responsible for building the airframe for the F-104 under licence will have to provide an additional investment in the order of DM 5 million ; for the G.91 the figure is estimated at approximately DM 2.5 million. Main contractor for production of the General Electric J79 jet powerplants for the F-104 will be BMW Triebwerkbau GmbH. The Klöckner-Humboldt-Deutz firm is responsible for the *Orpheus* engines for the G.91. Both companies will have to provide an investment of some DM 34 million. Daimler-Benz,

Henschel and MAN will be major subcontractors. Final assembly of the *Starfighter* will be carried out by Messerschmitt AG, and that of the Fiat G.91 by Dornier.

●

Two hundred Lockheed F-104G Starfighters are to be built in Canada under licence for the Royal Canadian Air Force. Orenda Engines Ltd., of Malton, Ontario, will manufacture the General Electric J79 jets, while Avro Aircraft, Canadair Ltd. and de Havilland Aircraft Co. (Canada) Ltd. have been invited to bid for the airframes. Total cost of the programme is estimated at $400 million, and it is expected to provide employment for 10,000 workers.

Under the agreement between the Canadian Government and Lockheed Aircraft Corporation, Canada will have the right to sell F-104Gs to any nation outside Europe. It is also planned that Canadian manufacturers shall supply as much as 20 percent of all airframes for the F-104Gs built in the United States. So far the total assured U.S. production of F-104Gs is 66 aircraft, for West Germany.

●

Olympic Airways and BEA have signed a "consortium" agreement for joint operation of their route networks between the United Kingdom, Greece and the Eastern Mediterranean. The agreement has been submitted to the Greek Government for approval. According to a joint statement, Olympic is buying de Havilland *Comet 4B* jets to supplement its DC-6Bs. It is understood that the initial order will be for two *Comets*, to be delivered in time for the 1960 holiday season.

●

The international aerobatics contest for the Lockheed Trophy, held at Baginton, near Coventry, from July 9th to 11th, was won this year by a Swiss pilot, Major Francis Liardon. This is the first time a Swiss has been world aerobatics champion. Liardon, a powered flight inspector at the Federal Air Office in Berne, has been flying for 25 years and holds all Swiss licences for fixed wing aircraft, helicopters and gliders.

●

British Overseas Airways Corporation is to resume its services to South America, suspended since 1954. Twice weekly services calling at Madrid, Lisbon, Dakar, Recife, Rio de Janeiro, Montevideo, Buenos Aires and Santiago de Chile, using de Havilland *Comet 4* aircraft are to start next January.

●

A new £130,000 civil airport to replace Stamford Hill has been opened at Virginia, Durban North. It has a 3,000-foot tarmac runway with a 3,400-foot grass strip alongside. The airport has night flying facilities and is designed for conversion to military use in time of emergency. A modern control tower is fully equipped with radio aids. Customs facilities are also planned.

●

At a ceremony at McGuire AFB, New Jersey, the F-106 Delta Dart long-range interceptor aircraft formally joined the aerial defence system for the New York-Philadelphia-Washington area. Commander of the new squadron is Lieut.-Colonel Reginald I. Hayes.

●

Trans Caribbean Airways Inc. reports total net income in excess of $5 million for the first six months of 1959, compared with a total net income of $864,721 for the same period in 1958. With stockholders' approval the carrier's name will be changed to *Transportation Corporation of America,* "to better reflect the company's various interests".

Workshop Briefs

Merckle Flugzeugwerke KG, of Bad Friedrichshall, Württemberg, has begun flight testing the prototype of its SM 67 turbine-powered helicopter. Pilot is Captain Bode. Provisional acceptance of the SM 67 was made only two days later, and flight testing is continuing. Merckle began work on the SM 67 in 1956 as a private venture, but continued under a Federal Government contract.

●

De Havilland is now considering the new Bristol ducted fan engine as an alternative to the Rolls-Royce RB.140 for the revised Airco D.H.121. This engine will probably be in the 9,500 to 10,000-lb thrust class. BEA has still not signed the 121 contract, and the situation is still far from clear.

●

Douglas Aircraft's engineering offices have been engaged for some time past on projects for large military transports, and brief details of two of these projects have now been revealed. One of them is known under project "CX Junior", and the other, a much bigger design, under project "CX". Both would be equipped with turbofan engines, and there is talk in this connection of the Pratt & Whitney JT4D (TF75), in the 23,000 to 26,000 lb thrust class. The smaller "CX Junior" (four JT4Ds) would have a layout for maximum payloads of up to 80,000 lb, reach cruising speeds roughly equivalent to Mach 0.8 and be capable of operating non-stop over distances of 3,700 nautical miles. The bigger "CX" version, also with Pratt & Whitney JT4D turbofans, would reportedly be capable of carrying payloads of around 100,000 lb non-stop across the Atlantic, or 50,000 lb non-stop across the Pacific. In other words, payload for a range of roughly 6,000 nautical miles would still be around 50,000 lb. Cruising speed would again be equivalent to at least Mach 0.8, and gross weight is given as approx. 480,000 lb.

●

Avian Industries Ltd., of Georgetown, Ontario, announces the Avian 2/180 two-seat autogyro (three-blade rotor with compressed air nozzles at the blade tips for starting; ducted pusher propeller at the fuselage rear). A prototype of the new autogyro, or "gyroplane", will be ready for flight testing at the end of September 1959. First deliveries could be made in March 1960.

●

A Fiat G.91 lightweight strike fighter was flown to Cazaux base in France in mid-July to undergo a series of tests with Nord 5103 air-to-air missiles. The main object of the tests is to determine whether these missiles can be used satisfactorily by the G.91. Firing tests are also planned.

●

The Fiat 7002 turbine-powered helicopter has completed static and dynamic tests of its stressed structure. All regulations covered by the Civil Airworthiness Requirements for this category of aircraft were satisfactorily met.

●

The U.S. Marine Corps was scheduled to begin a series of tactical evaluation trials with three *Gyrodyne* one-man helicopters at Quantico base, Virginia, on August 1st. The *Gyrodyne* YRON-1 was developed by Gyrodyne Corporation of America under a Navy contract. It weighs only 425 lb empty and is powered by a four-cylinder 62 h.p. Porsche engine. Cruising speed is 50 m.p.h., range 60 miles, and service ceiling about 6,500 ft. A useful load of 265 lb can be carried.

Three one-man XROE-1 helicopters built by Hiller will be evaluated later. This model has a 50 h.p. Nelson engine, and its specifications compare with those of the YRON-1 except that its range is only 27 miles.

●

The Chabay 4C10 lightweight engine, designed for use in sports aircraft, is a four-cylinder opposed type model (4-stroke) of roughly 100 h.p., which is scheduled to go into quantity production at the end of 1959.

●

Short Brothers & Harland is understood to be developing the Hurel-Dubois wing layout for the new light freighter project. Previously the high aspect ratio layout was being developed by Miles at Shoreham (in the HDM.106). It now appears that Miles has transferred its interest to Short.

●

Générale Aéronautique Marcel Dassault has developed an experimental missile for speeds equivalent to Mach 3.5. It has a solid-propellant motor for cruise (thrust 3,310 lb) and an undisclosed number of solid-propellant boosters with a unit thrust of 26,455 lb. In addition the missile has a liquid-propellant auxiliary power unit. Range is given as roughly 125 miles; weight, without boosters, 3,860 lb; weight of boosters 3,810 lb.

●

The first Northrop N-156F Freedom Fighter has arrived at the Northrop Corporation flight test hangar at Edwards AFB, California. The first flight was scheduled for the last week in July.

●

The Hiller X-18 experimental turbine-powered VTOL aircraft will begin flight testing within the next month or two, it is reported from the U.S. West Coast. Powerplant consists of two Allison T40 propeller turbines.

●

General Electric has received FAA certification for its T58 turboshaft engine, known as the CT58-100-1. Certification is for a take-off power of 1,050 s.h.p. and a continuous power of 900 s.h.p. The engine is fitted, for example, in the Sikorsky S-61 and S-62 and the Vertol 107 helicopters.

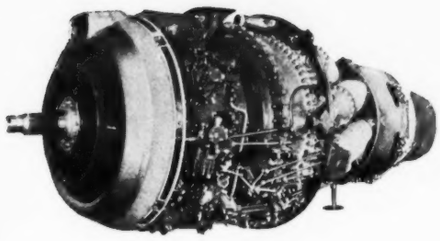
●

A Sud-Aviation SE-4400 surface-to-air test vehicle has been mentioned for the first time. The vehicle is launched by a solid-propellant booster and is being used to test a new ramjet engine with multiple shock diffusor. Launching weight 2,645 lb, overall length 23.6 ft, max. speed equivalent to Mach 3.6, ceiling 31 miles.

●

ACAM 5301 is the designation of a new surface-to-air missile developed by Nord-Aviation. It has a range of roughly 9.3 miles and a launching weight of 1,060 lb; max. speed is more than 1,970 f.p.s.; warhead roughly 90 lb; length 14.76 ft. ACAM 5301 was derived from the Nord 5103 air-to-air missile, and is roughly comparable to the American *Hawk*.

Photo credits: Front cover: Air Ministry, Paris; pp. 919-930: Howard Levy (1), Len Sirman Press (1), USIA (1), manufacturers (4), Interavia (79); p. 931: Interavia; pp. 943-948: ATP (1), manufacturers (5), Interavia (33), Interavia files (14); pp. 949-950: AFP, Service Photographique, Paris; pp. 961-963: manufacturers; pp. 967-968: manufacturers (1), Interavia (16); p. 969: manufacturers (1), Interavia (9); p. 971: Ministry of Defence, Rome; pp. 972-975: manufacturers; pp. 984-985: manufacturers; pp. 986-987: Sovpress (4), works drawing (1), Interavia (5); pp. 988-990: manufacturers.



DART PROP-JET

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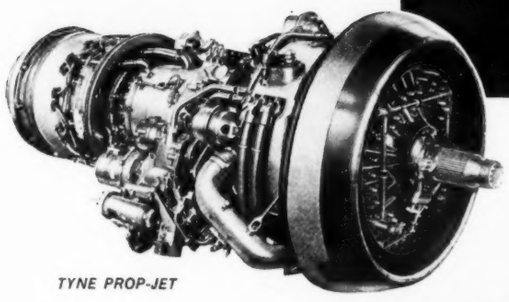
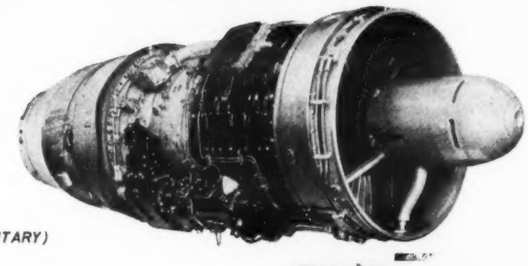
POWER
IN THE SERVICE OF AVIATION

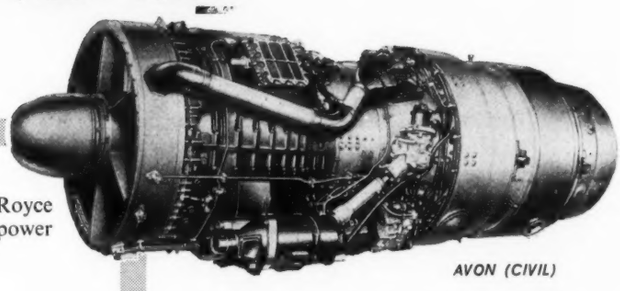


TYNE PROP-JET

The Rolls-Royce Aero Engine Division is the largest organisation in Europe producing aero engines for Civil and Military use. Over 34,000 people are employed in the design, development and manufacture of turbo jets and prop-jets which are in service with or on order for 21 armed forces, over 60 airlines and more than 20 other operators throughout the world. Rolls-Royce are developing the rocket motor for Britain's long range ballistic missile.

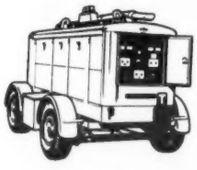


AVON TURBO JET (MILITARY)

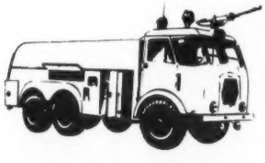


AVON (CIVIL)

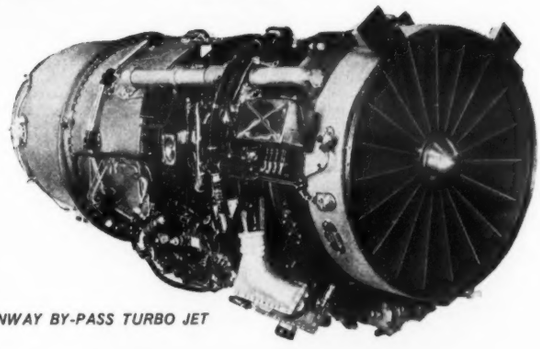
Aviation is also served by Rolls-Royce Diesel and Petrol engines which power airfield and ground equipment.



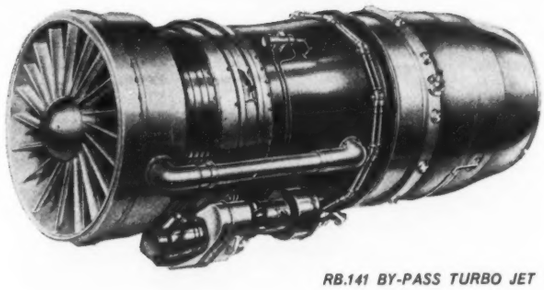
Petbow Ground Starter Unit powered by a Rolls-Royce Diesel Engine.



Airfield Crash Tender on a Thornycroft Chassis powered by a Rolls-Royce Petrol Engine.



CONWAY BY-PASS TURBO JET



RB.141 BY-PASS TURBO JET

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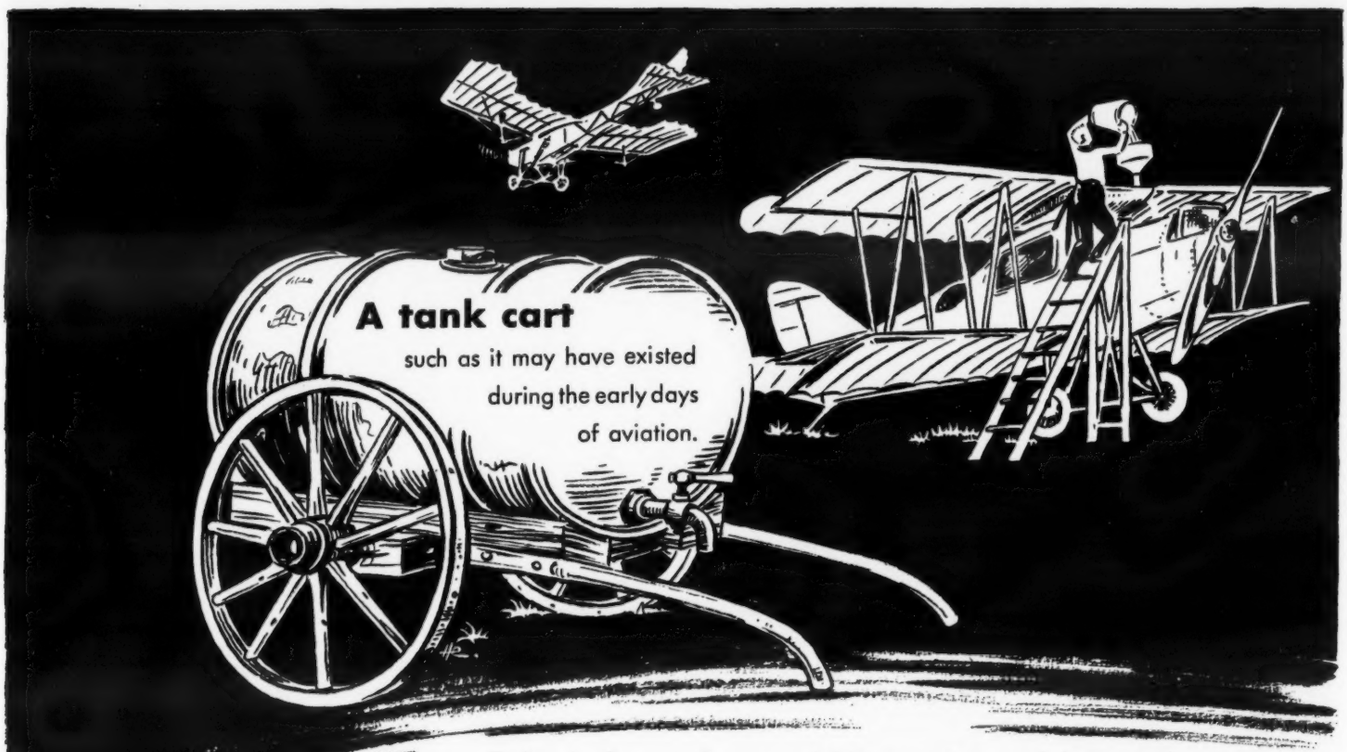

. . . Today, in the era of commercial jet operation, much larger tank capacities are required.

The latest **STRÜVER aircraft refueler** holds

7700 I. G. (9250 US gal.)

Its rate of discharge of 530 I. G./min (635 US gal./min) makes possible rapid and efficient refueling with ground time kept to a minimum. A still bigger **9900 I. G.** (11900 US gal.) unit is at present under construction.

AD. STRÜVER GMBH TANKWAGENBAU HAMBURG

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- Portable *"Pillow Tanks"* for low-cost liquid storage . . .
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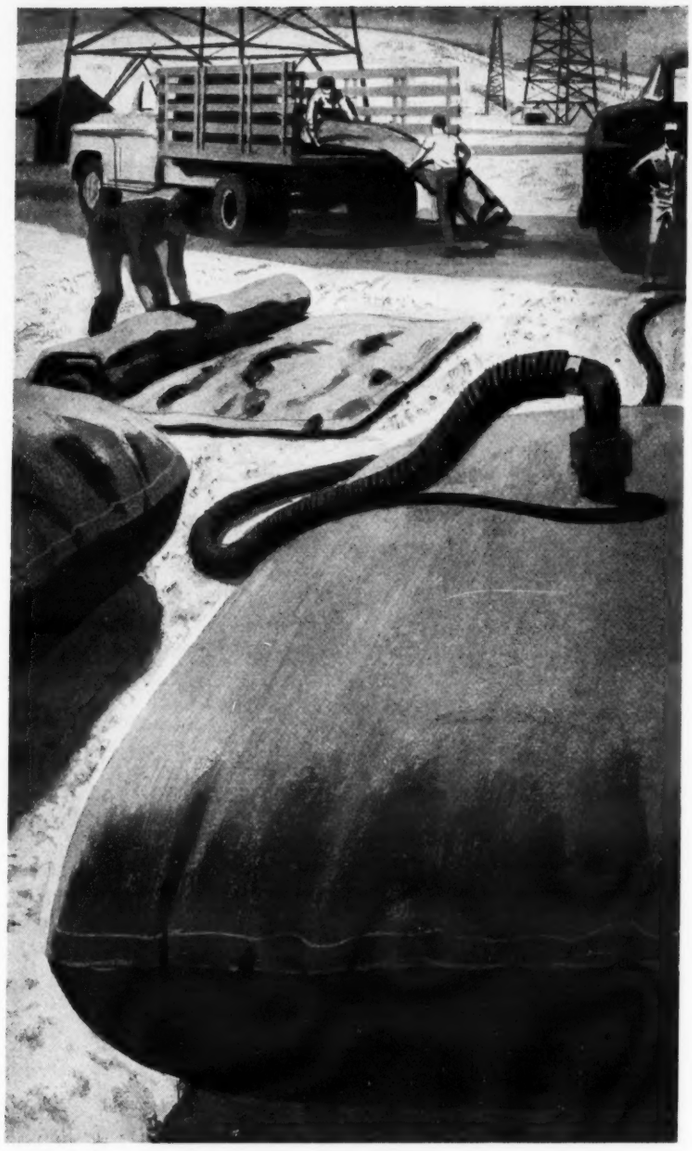
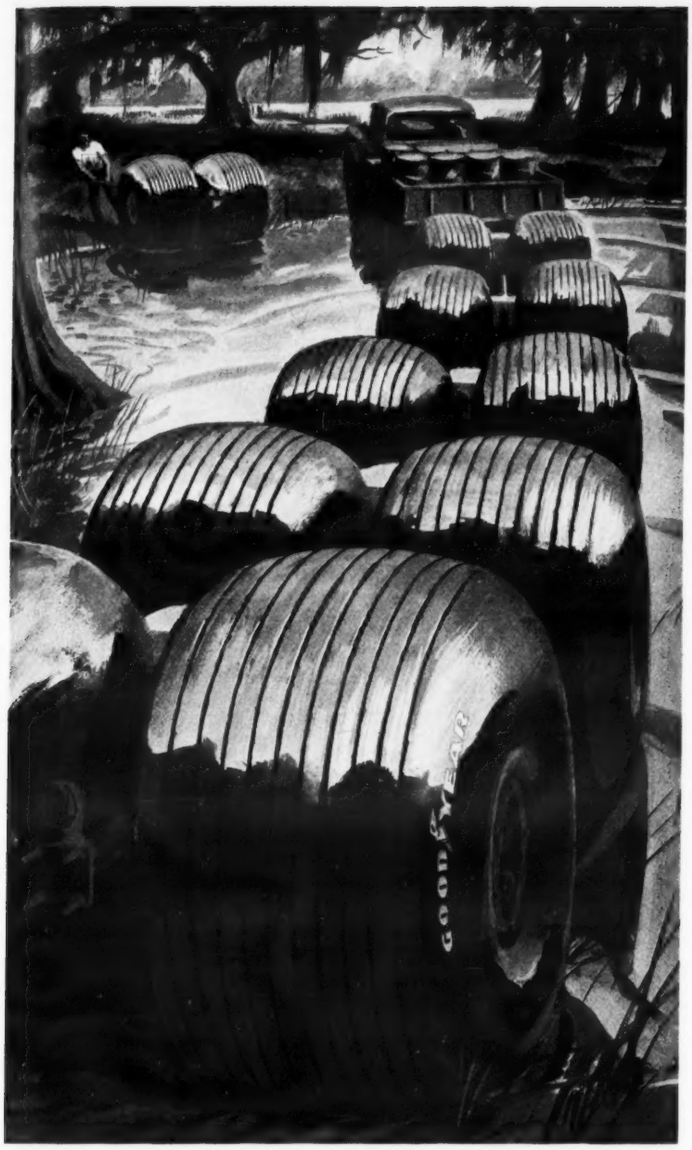
- Axle-driven *Terra-Tires* for "go anywhere" mobility . . .

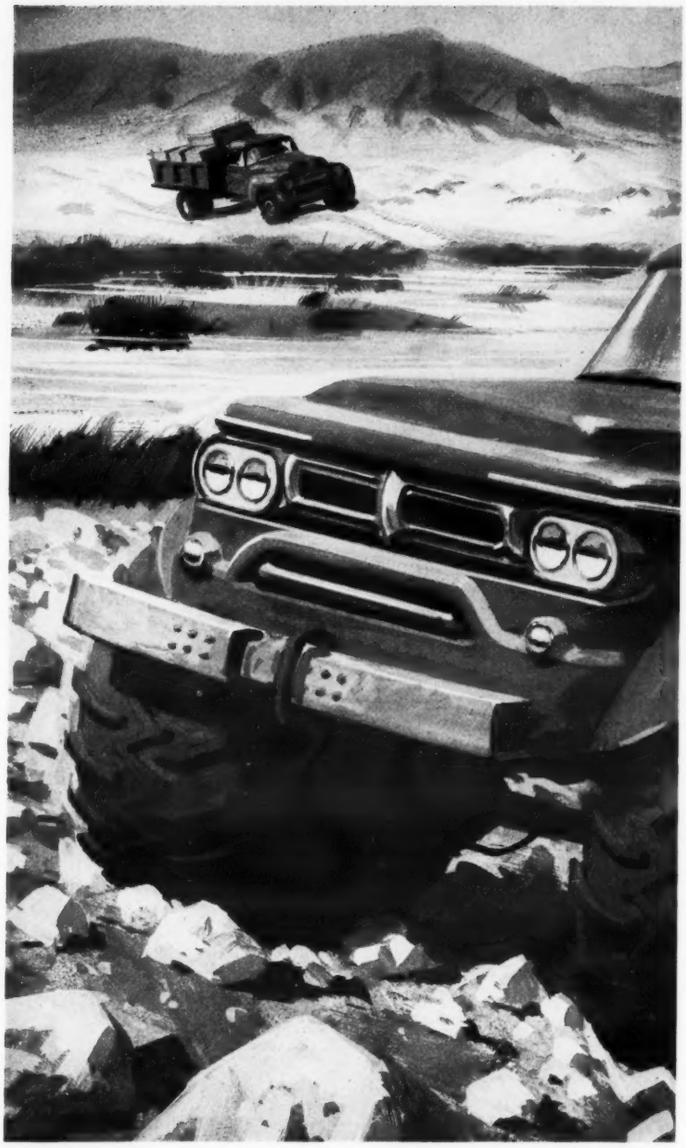
How can these Goodyear rubberized products increase mobility while lowering costs for you? Write for all the facts to Goodyear International Corporation, Aviation Products Division, Akron 16, Ohio, U.S.A.



1 WANT TO SAVE ON FUEL STORAGE COSTS? Then, consider the "Pillow Tank"—tough, rubberized fabric container by Goodyear that unrolls like a rug, can be filled and pumping 45 minutes after delivery, eliminates need for heavy, hard-to-handle steel drums. Designed for all-weather use wherever temporary or emergency storage or transport of bulk liquids is required, "Pillow Tanks" are perfect for use on farms—in oil fields—at remote construction sites. Gasoline, oil, water—even granular solids—can be stored in these ingenious tanks. They are available in sizes up to 50,000 gallons, yet occupy only a minimum amount of space when rolled up.

GOOD





2 THIS IS THE ROLLI-TANKER. Tire-like tankers hold up to 500 gallons, glide over softest terrain without sinking in. Train of Rolli-Tankers can provide fuel and water along entire route of a road construction job. Taken in tow, they offer minimum rolling resistance, and free the truck itself to take its normal pay load of other materials. Regular work truck can unhitch Rolli-Tankers where needed and pick them up again after use. This eliminates need for tank truck—also eliminates transferring liquids to separate dispenser containers. Rolli-Tankers may also be towed through water. They have natural buoyancy, roll right up the beach. Or — Rolli-Tankers may be air-dropped into remote areas.

3 "GO ANYWHERE" TIRE is another name for the Terra-Tire, developed by Goodyear to give vehicles unprecedented mobility. Axle-driven and axle-loaded, these drum-shaped pneumatic tires conform to the ground contour—are virtually immune to punctures and blow-outs. One of their many applications: on trucks which must go into rough off-the-road areas during oil exploration. Tires have exceptional strength—due to all-nylon cord construction and exclusive *triple-tempering* process. High strength, combined with great flexibility, enables Terra-Tire to roll easily over rocks, stumps, other obstacles. And the ride is so cushion-soft that springs aren't needed.

YEAR

Terra-Tire, Rolli-Tanker—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio, U. S. A.

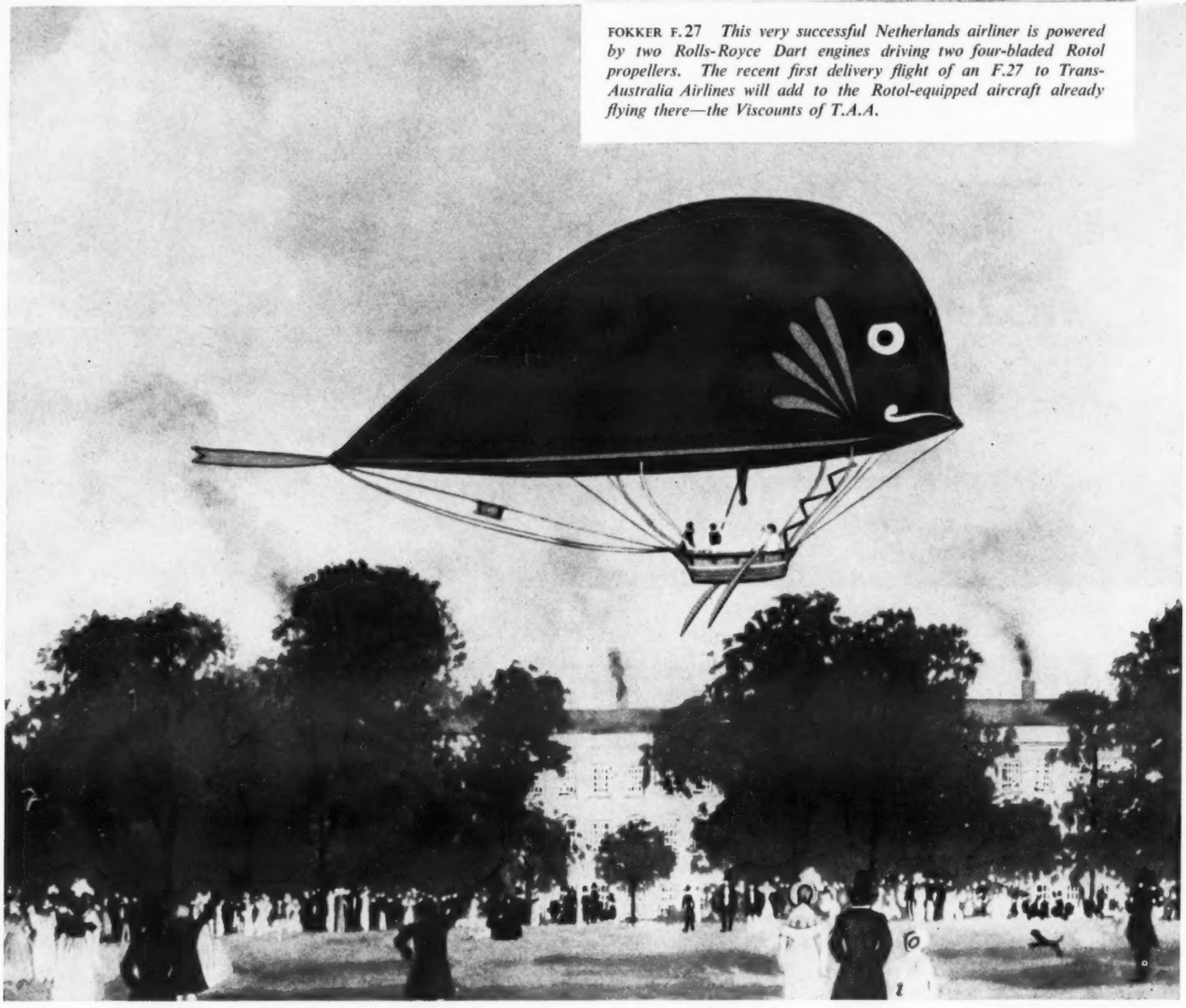
Propulsion through the ages...

A charming Regeney folly

Among the many designs for dirigible airships which appeared between the invention of the balloon in 1783 and the arrival of the first practical airship in 1852, the most delightful was the DOLPHIN, designed by Pauly & Egg in 1816-17. Apart from the absurd " oar " propellers, it was to have had an interior balloonet to preserve its shape, and a device (visible here) to alter the trim by means of a moveable weight. Such ingenuity surely deserved success—but alas, the triumphal flight shown here took place only in the artist's imagination.

From near-fantasy to historical fact: Rotol were the pioneers of the turbo-prop, for they designed and built the propellers for the first turbo-prop aircraft to fly—and today over 100 airline and aircraft operators fly machines with Rotol propellers.

FOKKER F.27 *This very successful Netherlands airliner is powered by two Rolls-Royce Dart engines driving two four-bladed Rotol propellers. The recent first delivery flight of an F.27 to Trans-Australia Airlines will add to the Rotol-equipped aircraft already flying there—the Viscounts of T.A.A.*



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SUCCESSFUL FLIGHT OF USAF T-38 PROVES HIGH PERFORMANCE OF NORTHROP LOW-COST AIRCRAFT!

Successful flight tests at Edwards Air Force Base, California, indicate that the USAF-Northrop T-38 Talon more than qualifies for its unique mission. Now in production under USAF contract, it fills a vital need for a high-performance, low-cost aircraft in which the new generation of space-age airmen can safely master the art of supersonic flight.

BEING DEVELOPED IN PARALLEL IS NORTHROP'S N-156F—the only fighter under USAF contract created especially to fit the specific tactical and economic requirements of other free-world nations. The N-156F—the Freedom Fighter—is a supersonic weapon system that offers total combat effectiveness superior to any other American front-line fighter.

The N-156F matches effectiveness with economy. It costs far less to buy, to fly, and to maintain. And of equal importance, the N-156F is designed for production outside the United States and will make a substantial contribution to the economies of the countries it will defend.

Final N-156F mockup. First production-line fighter was rolled out in May and flight tested in July.

NORTHROP INTERNATIONAL
Beverly Hills, California, U.S.A., A Division of Northrop Corporation

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*A VITAL FACTOR IN JET STARTS

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The Air Partner is a surge-free rotary screw compressor of the Lysholm type designed for starting, air conditioning and de-icing all jet and turbo-prop airliners having air turbine starters.

A SUCCESSFUL COMBINATION
Atlas Copco, the world's largest organisation devoted exclusively to the manufacture of compressed air equipment, combined aeronautical expertise with compressor know-how to produce this multi-purpose unit.

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The Air Partner delivers a continuous flow of warm, oil-free air to turn the engine over constantly thus eliminating mis-starts.

AIR CONDITIONING
The Air Partner becomes an air conditioning unit by merely flicking the appropriate switches and pressing a button, a matter of seconds.

DE-ICING
A special mouthpiece attached to the air hose enables the wings and fuselage to be 'sprayed' with warm air. Removal of ice and sleet from windshields, wing leading edges, and air intake lips is achieved by using the ordinary de-icing outlets of the aircraft.

SIMPLE MAINTENANCE
The Air Partner has no wearing parts. It consists of two screw rotors which intermesh but never touch one another or the casing. 10,000 hours is the normal period between overhauls for screw compressors of this type.
Maintenance operations can be carried out by airline personnel anywhere in the world or through the Atlas Copco sales and service organisation established in 90 countries.

TWO MODELS
Air Partner M-3 consists of two identical units, each including a compressor connected to a standard petrol or diesel engine, for starting, air conditioning, de-icing and checking auxiliary systems.
Air Partner M-2 consists of one rotary screw compressor connected to a standard petrol or diesel engine for starting and limited air conditioning.

THE *Atlas Copco* AIR PARTNER

A contribution to the jet age of air travel

Contact your local Atlas Copco company or agent or write to Atlas Copco AB, Stockholm 1, Sweden

The San Diego ICAO Assembly in Brief

The International Civil Aviation Organization announced its firm intention not to be caught napping in future by the rapid development of air transport ... Reduced to its bare essentials, such was the outcome of the 12th Session of the ICAO Assembly, which was held in San Diego, California, from June 16th to July 9th, 1959 and was attended by 62 of the 74 member States as well as by observers from two non-member countries and nine international organizations.

The chairman of the session was E. R. Quesada, Administrator of the United States Federal Aviation Agency, and the programme was outlined in the annual report presented by Walter Binaghi, President of the ICAO Council.

*

When Walter Binaghi, an Argentine engineer and civil servant, succeeded the first Council President, the late Edward P. Warner, two years ago, he was a more or less unknown quantity. Admittedly he had been Argentine delegate to ICAO since 1947 and had presided over the 1954 Session of the Assembly in Montreal. But he was a young man of 38 and scarcely known in the outside world. In any case there were few who could have had any very tangible idea of Binaghi's programme and his importance to the International Civil Aviation Organization.

Meanwhile it has become abundantly clear that the new Council President is fully aware of where the shoe pinches ICAO and is determined to tackle the economic tasks which, though covered in the Organization's statutes, had hitherto been allowed to "slumber". ICAO was set up under the Chicago Convention on International Civil Aviation, Article 44 of which laid down that the new Organization should be responsible not only for the technical coordination of civil aviation, but also for economic supervision and promotion of air transport : "Meet the needs of the peoples of the world for safe, regular, efficient and economical air transport... Prevent economic waste caused by unreasonable competition... Ensure that the rights of contracting States are fully respected and that every contracting State has a fair opportunity to operate international airlines."

At the Assembly session in San Diego, Council President Binaghi sounded a clear warning against over-estimating the public acclaim of jet transport : "Speed, comfort and novelty have influenced the travellers, but it must also be remembered that, at present, the total capacity offered by these new large jet aircraft is small and that such high load factors will not be maintained when all of the new fleets are operating, unless unprecedented increases in traffic take place or unless the present reciprocating-engine airliners are disposed of..."

"... The airline traffic situation in 1958 was not a good one ; in effect, the rate of expansion in airline traffic on a world-wide basis, measured in passenger-kilometres, was only 5.2 percent, much less, in fact, than the 15 percent per annum average growth to which we have become accustomed during the last years..."

IATA Gives More Optimistic Figures for 1958

The 1958 traffic figures published by the International Air Transport Association for its member airlines at the end of July 1959 showed some gratifying gains over the previous year.

The number of passengers carried reached a new record level of 69,249,000, or an increase of 7.3 percent over the figure for 1957. International traffic grew by 12.4 percent, and domestic traffic by 6 percent.

The volume of cargo (in tonne-kilometres) rose by 21.5 percent, and of airmail by 10.3 percent.

For revenue passenger-kilometres IATA reports an increase of 7.4 percent to 75,165,000,000 (international + 16.5 percent, domestic + 3.2 percent).

When it comes to load factors, however, IATA is obliged to use minus signs : revenue passenger load factor 59.6 percent (— 3.1 percent compared with 1957) ; revenue weight load factor 57 percent (— 0.6 percent).

The total fleets of IATA member airlines increased by 9.4 percent to 3,398 aircraft, and total employee strength by 8.9 percent to 366,000.

Left to right : H. E. A. Karim Hakimi (Afghanistan), 4th Vice-President of the Assembly session ; ICAO Council President Walter Binaghi (Argentina); E. R. Quesada (USA), President of the Assembly session ; A. Kofoed-Hansen (Iceland), 1st Vice-President of the session ; Colonel U. B. Caldoza (Philippines), 3rd Vice-President of the session.

"... Regarding the financial situation of the world's scheduled airlines... final figures indicate for the year 1957 a net operating loss of $41 million against a net operating profit of $84 million in 1956. For 1958, only preliminary estimates are possible, and they seem to indicate that there has been a further deterioration in the financial picture during that year. The world economic situation certainly influenced the figures obtained for 1957 and 1958, but we must not conclude that the general economic trend so much controls the growth of air transport ; at least that does not seem to have been proved by figures in the past. Important factors in the airlines' financial picture are the rise in unit costs and the decline in load factors. Solutions will have to be found if we want to see a continuing healthy growth in air transport."

*

It is scarcely necessary to add that technical deficiencies in the world network of air navigation services and facilities are given equally detailed treatment in the report, and that the Assembly requested the ICAO Council to prepare *proposals, as soon as possible, for improving navigation aids and for some form of joint financing of ground facilities.*

But ICAO's new line was reflected even more clearly in another resolution. The Organization is evidently determined not to see the experience of "stumbling" into the jet age repeated a second time. The Assembly urged the Council to begin immediately on a *study of the technical, economic and social consequences of supersonic civil aircraft,* which can be expected to become available for commercial service within the period ending about 1975. The study is also to assess the problems of noise, land use, etc., so that governments can be provided with all the required information for preparing the introduction of supersonic travel in good time.

*

The following are some of the more important of the remaining results of the San Diego session :

- West Germany, Guatemala and the Philippines were elected to the 21-State *ICAO Council,* in succession to Belgium, Ireland and Mexico who had completed their three-year term of membership. Under a system of rotation agreed upon among the Scandinavian countries, Denmark replaces Sweden.[1]
- The new Council confirmed its *President Walter Binaghi* in office for a further period of three years.
- *Ronald M. Macdonnell* (Canada), who had been elected Secretary General at the end of 1958, was sworn in, in succession to Carl Ljungberg, who retired on August 1st.

[1] The ICAO Council now comprises the following members : Argentina, Australia, Brazil, Canada, Denmark, France, Federal Republic of Germany, Guatemala, India, Italy, Japan Lebanon, Netherlands, Philippines, Portugal, Spain, Union of South Africa, United Arab Republic, United Kingdom, United States and Venezuela.

INTERNATIONAL MEETINGS AND CONFERENCES

August 8th-9th : 3rd Flying Rally, organized by the Aero Club of Central Alsace. Colmar.

August 9th-12th : ASME-AICE Heat Transfer Conference. Storrs, Conn.

August 17th : First National Ultrasonics Symposium, Institute of Radio Engineers Professional Group on Ultrasonics Engineering, Stanford University, Stanford, Calif.

August 18th : Meeting of ICAO Legal Committee. Munich.

August 18th-21st : 1959 Western Electronic Show and Convention. San Francisco, Calif.

August 23rd-29th : 1959 International Round-Switzerland Flight.

August 24th-26th : ARS Gas Dynamics Symposium : Dynamics of Conducting Fluids. Evanston, Ill.

August 27th-29th : American Physical Society 1959 Summer Meeting in the West. Honolulu, Hawaii.

August 27th-28th : British Commonwealth Space Flight Symposium. London.

August 27th-30th : International Swedish West Coast Rally organized by Gothenburg, Varberg, Trollhättan, Uddevalla and Boras Aero Clubs.

August 30th : Oxford Aeroplane Club " At Home ". Kidlington.

August 31st-September 2nd : Fourth International Symposium on Free Radical Stabilization. Washington, D.C.

August 31st-September 5th : Tenth Annual International Astronautical Federation Congress. London.

September 1st-2nd : Conference on physical chemistry in aerodynamic and space flight. University of Pennsylvania, Philadelphia, Pa. Sponsored by Air Force Office of Scientific Research and General Electric Co.'s Missile and Space Vehicle Dept.

September 2nd : ICAO, 5th Session of the Meteorology Division. Montreal.

September 2nd-4th : 1959 Cryogenic Engineering Conference, University of California. Berkeley, Calif.

September 3rd-6th : Air Force Association Convention and Panorama, Miami Beach, Fla.

September 4th-6th : International Flying Rally. Brunswick.

September 5th-6th : Popular Flying Association Rally. England.

September 6th-20th : International Engineering Fair. Brno.

September 7th-13th : SBAC Display and Exhibition, Farnborough.

September 9th-11th : Midwestern Conference on Fluid and Solid Mechanics, cosponsored by IAS, AFOSR, ONR, NSF. Austin, Texas.

September 10th : Canadian International Air Show at the Canadian International Exhibition. Toronto.

September 11th-13th : German Aero Club Flying Rally. Baden-Baden.

September 12th : IATA Traffic Advisory Committee. Honolulu, Hawaii.

September 12th-21st : Sixth European Machine Tool Exhibition. Paris.

September 13th-19th : Golden Anniversary of Flight Week and International Air Show. Windsor, Ont.

September 14th : IATA Composite and Joint Meeting of Traffic Conferences. Honolulu, Hawaii.

September 14th-19th : First International Conference on Agricultural Aviation. Cranfield, Bedfordshire.

New York Finance Notes

Turn of the Tide for the Airline Industry ?

BY SCOTT HERSHEY, NEW YORK

The New York Exchange started the second half of 1959 by setting historic highs in industrial and combined stock averages, pushing ahead on an almost unbroken front, and even the airlines were buoyant.

This is due partly to the fact that the major domestic lines have reported substantial increases in business in the first months of the year, and advance reservations indicate the possibility of a banner year in travel. The rapidly growing fleets of jets are receiving gratifying high acceptance in the travel field.

Thus, the transition to the jet era is being eased by the fact that revenue and profits on most lines are on the rise. This trend contrasts happily with the tailspin experienced by the industry a year ago. At that time, the slump in general business proved a heavy drag on traffic.

Earnings virtually were grounded by a combination of things, and in the winter and early spring of 1958 the airlines appeared more likely to be headed for serious trouble than for a bright new era in transportation. About the middle of last year the fortunes of the industry took a turn for the better. The recovery in the economy at large fueled an upsurge in air transport travel, and the improvement is accelerating this year.

It appears, in fact, that the traditional pattern of airline growth once more is beginning to assert itself. From an operating standpoint the industry appears to be far better equipped than it was twelve months ago to make the switch from piston-powered aircraft.

Virtually all U. S. carriers have arranged to obtain the necessary funds or credits to pay for equipment on order, which, at the end of last year exceeded $ 1.6 billion.

Industry financial experts pointed out, however, that existing loans as well as credits yet to be drawn on are subject to the maintenance of certain debt-equity ratios and assets or working capital requirements. To the extent that earnings and proceeds from surplus aircraft sales and self-generation of cash fall short of providing the necessary funds, the lines will have to go into the capital market for additional equity.

The equity positions of many carriers seem rather thin at this time to support the full weight of the capital commitments which they have undertaken. However, the airlines are confronted with a buyers market, and the shift spells the end of the re-equipment cycles in which capital gains automatically could be taken down as older aircraft were phased out.

Two carriers recently announced plans for new financing. Pan American plans to offer approximately $ 47 million of convertible subordinated debentures to its stockholders through subscription rights. The line is filing with the Securities and Exchange Commission a registration statement to cover the offering. The carrier expects to offer to stockholders of record July 29th rights to subscribe for the debentures at the rate of $ 100 of debentures for each 4 shares held. Pan American shares on the New York Stock Exchange were quoted recently at 29 3/8. High for the year was 34 1/4 and low 22 1/8.

The other recent financing was an announcement by Airborne Carriers, Inc., a subsidiary of Aviation Financial Services, that $ 9,429,000 of Airborne's first and second mortage notes had been privately placed. Sale of the notes was arranged in connection with financing of a $ 23,000,000 purchase of five Canadair CL-44 turboprop aircraft by Seaboard & Western Airlines, the cargo carrier.

The funds from the notes will provide Seaboard with its required 10 percent down payment on the new aircraft and with additional working capital. The planes are scheduled for delivery by the spring of 1961, and Seaboard will pay an additional 10 percent on delivery and the balance in monthly payments over five years.

Seaboard, meanwhile, has sold to Airborne five *Super Constellations* and fifteen engines for the amount of the notes, $ 9,429,000. The air carrier will lease back this equipment for 27 months at a monthly rental of $ 35,000 a plane and $ 1,500 an engine.

Operation, and plans for the operation, of pure jet and turboprop air transports had spread to 87 carriers in 42 countries up to the end of June, according to a survey by the aviation department of Esso Export Corporation.

These carriers had placed orders for a total of 1,054 aircraft in the two classifications for delivery between 1958 and 1963. Many of the planes, of course, already are flying on lines throughout the globe.

Total orders include 486 in the turboprop category, with 243 medium-range and 243 long-range models. The rest of the total consists of 568 medium and long-range pure jets, of which twelve were delivered in 1958 and 132 are due this year. In 1960, the total will be 300 ; sixty-five in 1961, and fifty-nine in 1963.

Two foreign lines have attracted attention recently with their growth reports. Alitalia, the Italian airline, moved up last year to twelfth place in size of operations among the world air carriers, and gains are continuing this year. In 1958 passenger miles operated increased 36.9 percent over the year before ; the number of passengers carried was up 37.4 percent ; mail volume rose 25.7 percent and express and freight increased 15.6 percent. Preliminary figures for the first half of this year show that the number of passengers increased 130 percent over a year ago with a rise of 100 percent alone for June.

Ethiopian Airlines, which received management and technical assistance from Trans World Airlines, also reported record traffic volume and revenues during last year. The line is looking to extend its routes to West Africa and is studying all available aircraft, including jets, for additions to its fleet. The carrier last year extended its intercontinental route northward from Athens to Frankfurt.

The airline industry definitely is buoyant and on the move.

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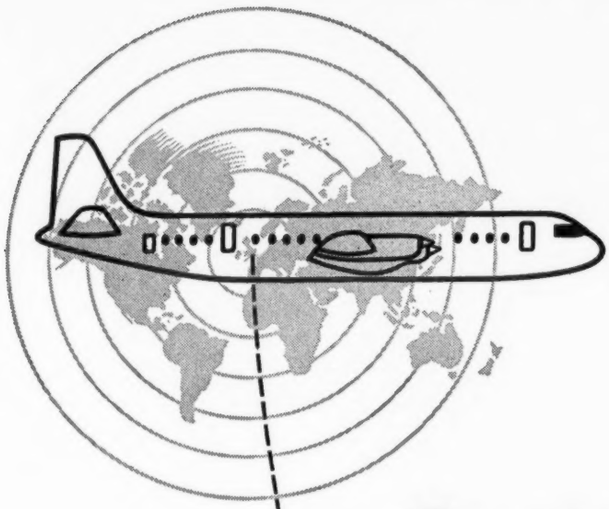

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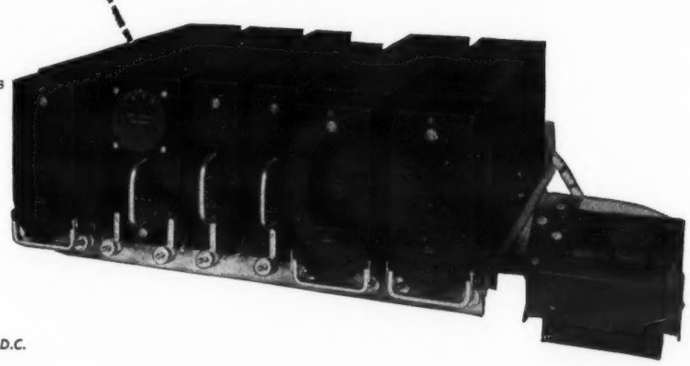

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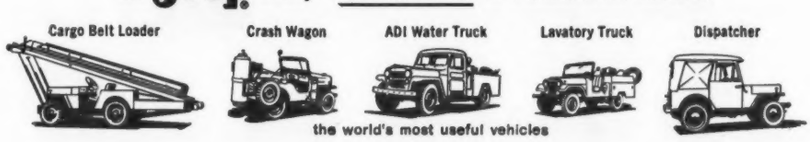

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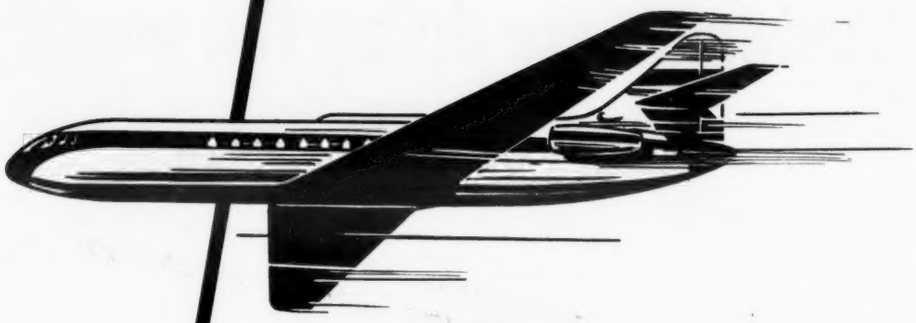

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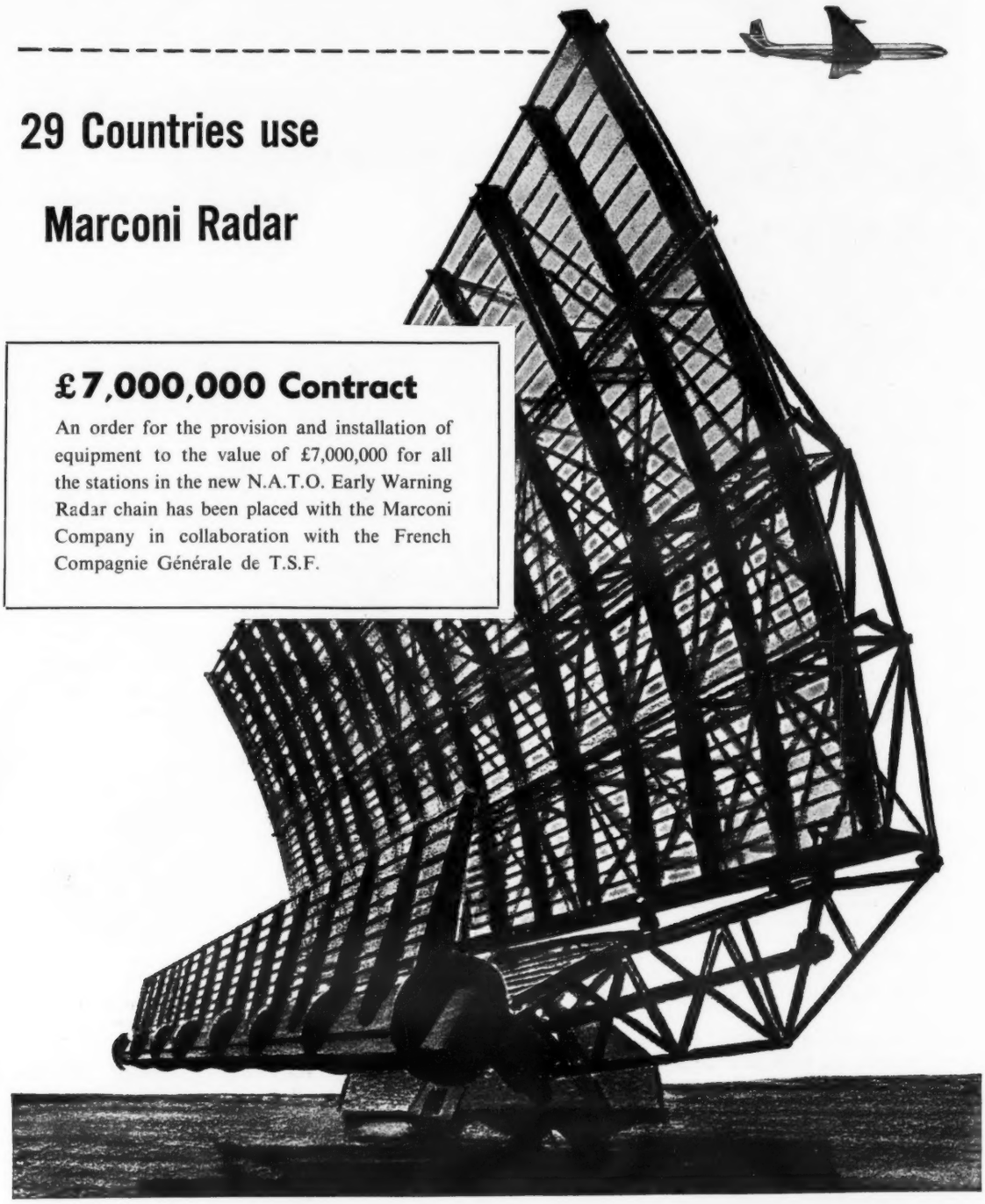

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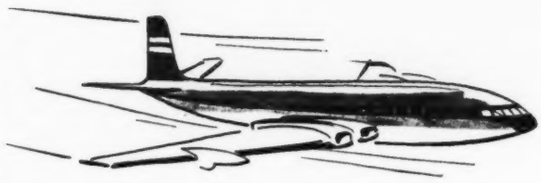

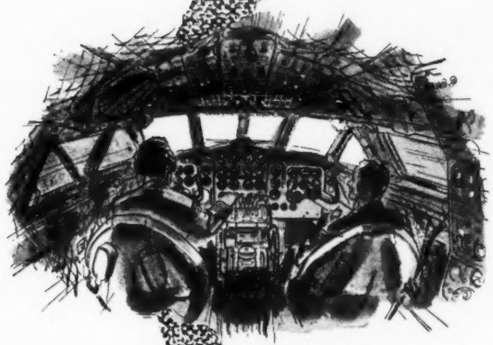

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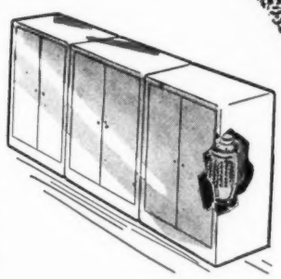

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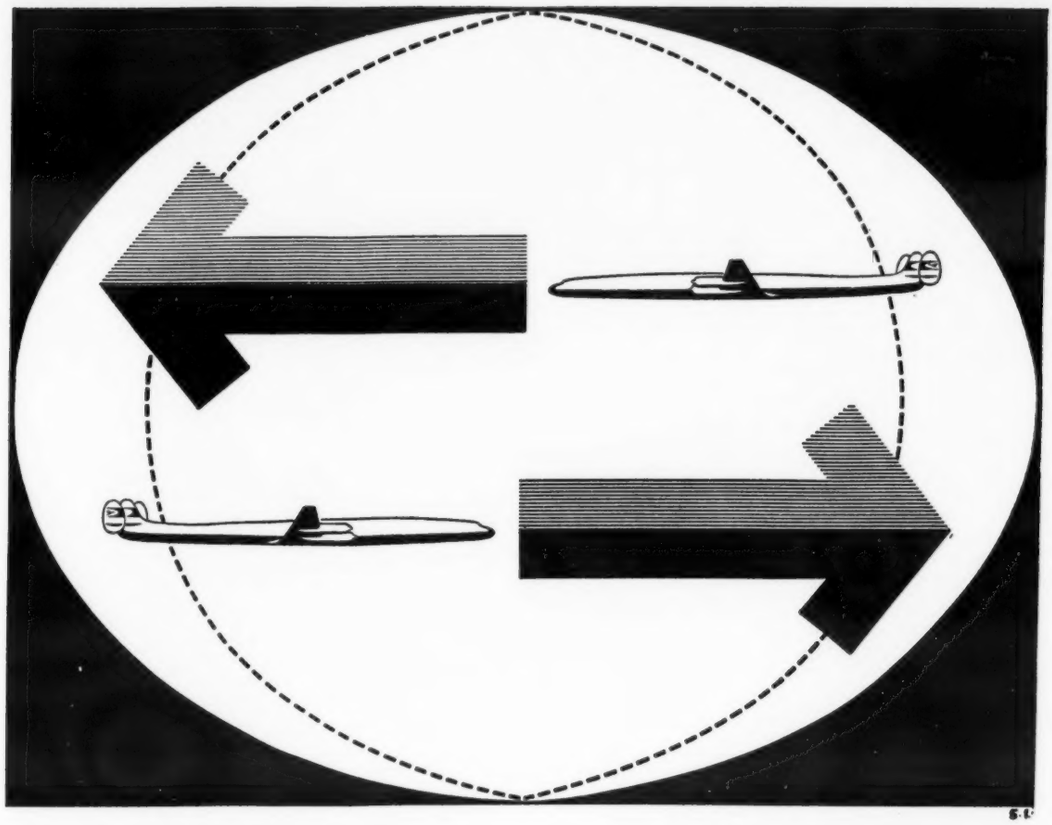

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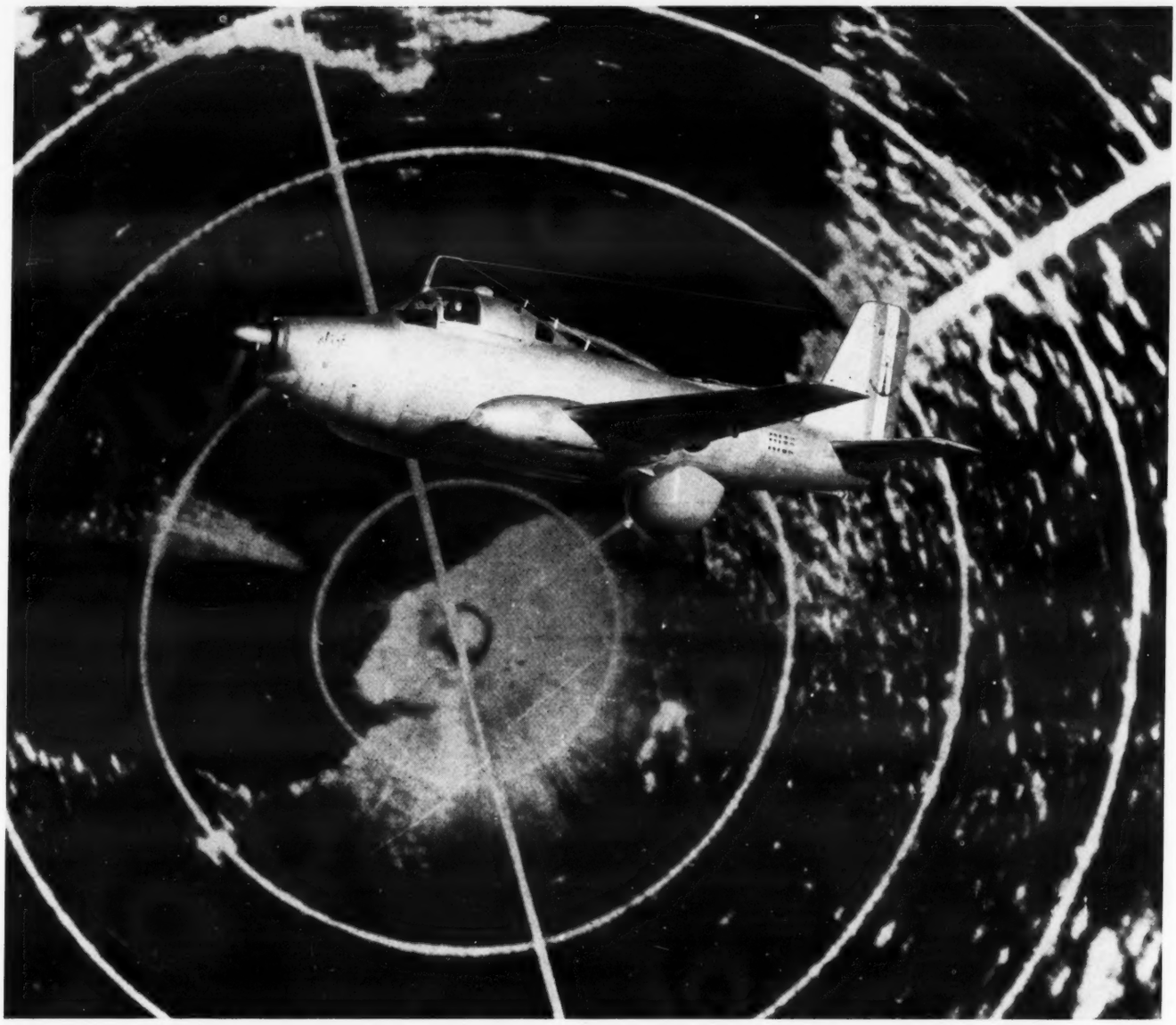

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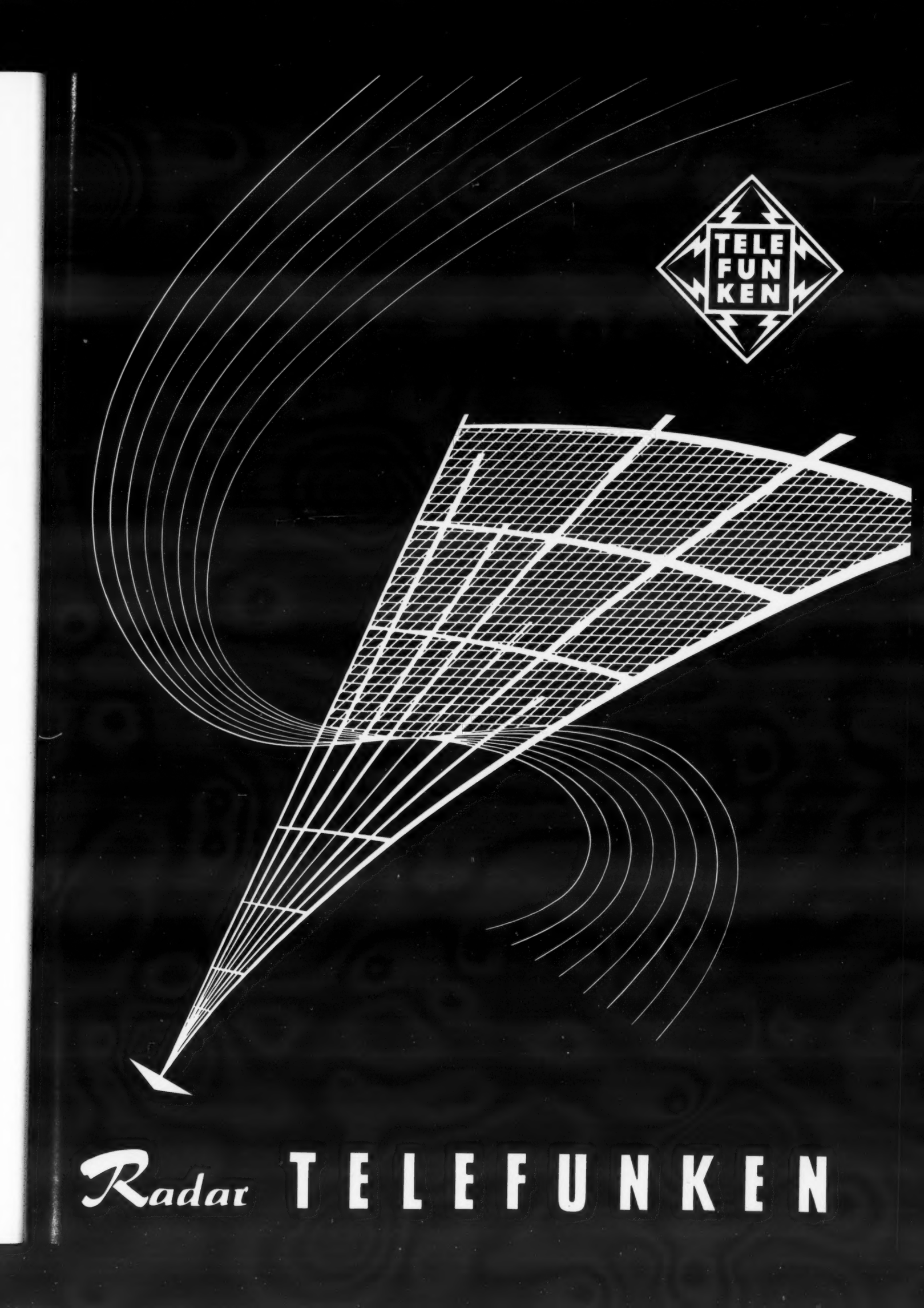
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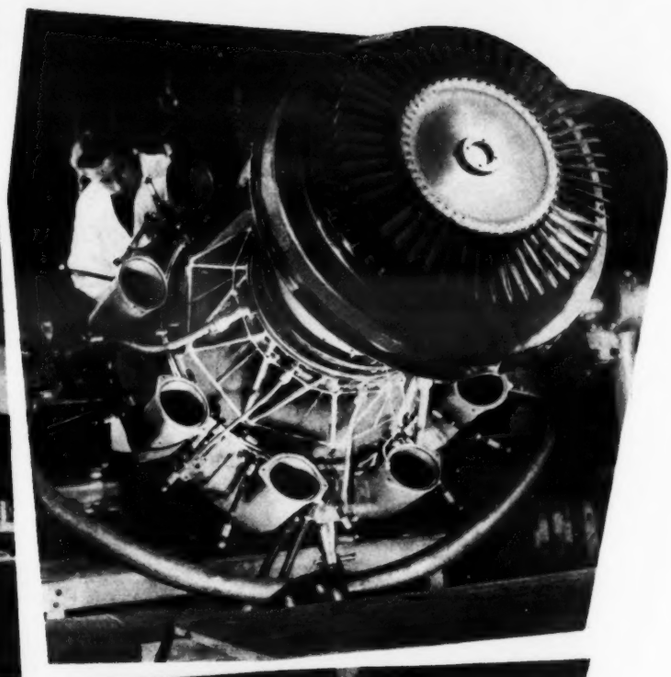

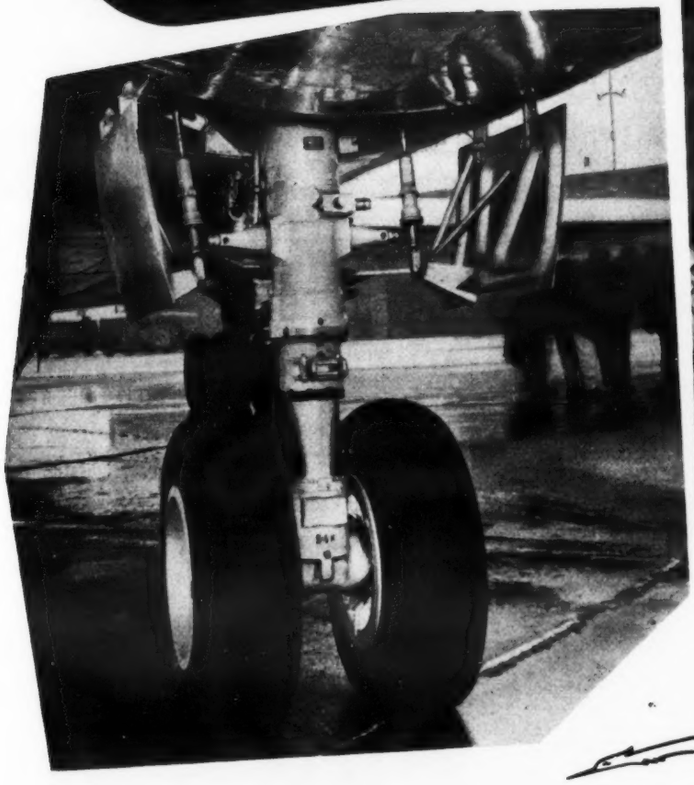

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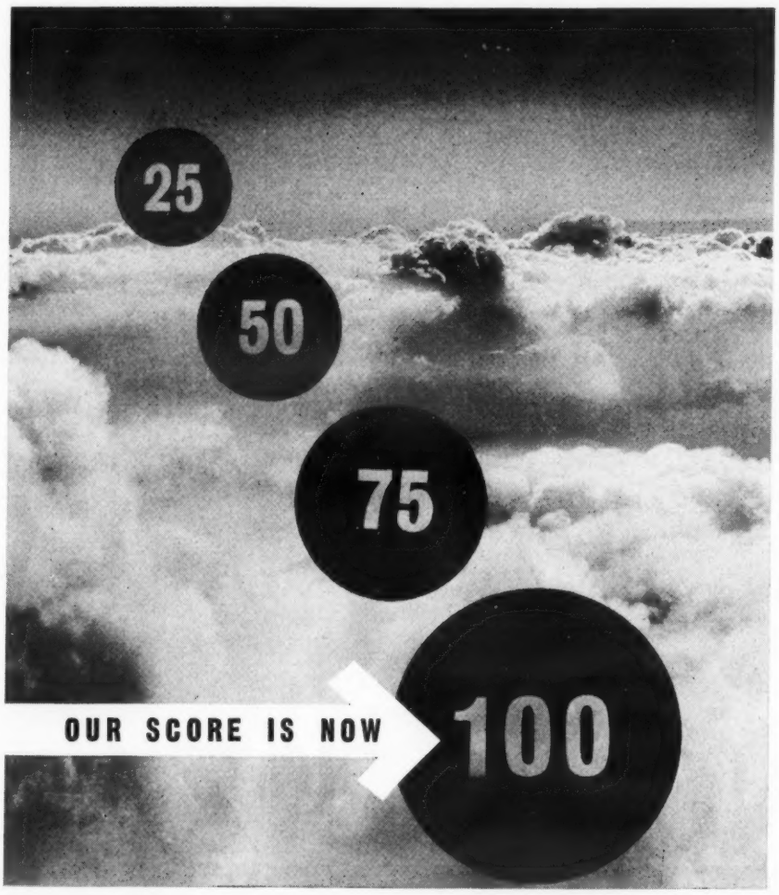

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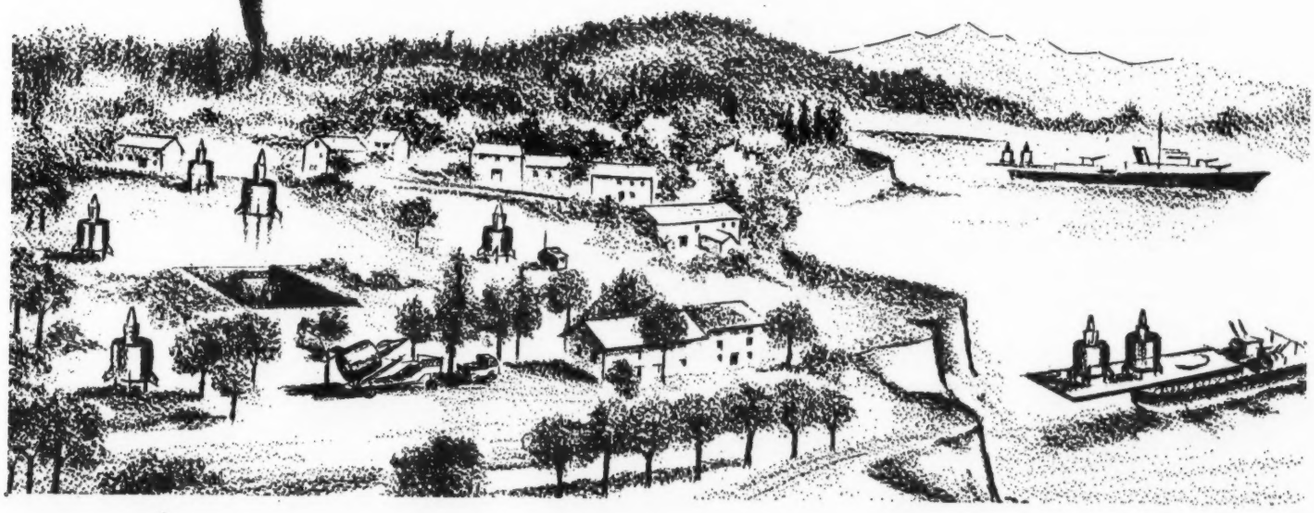

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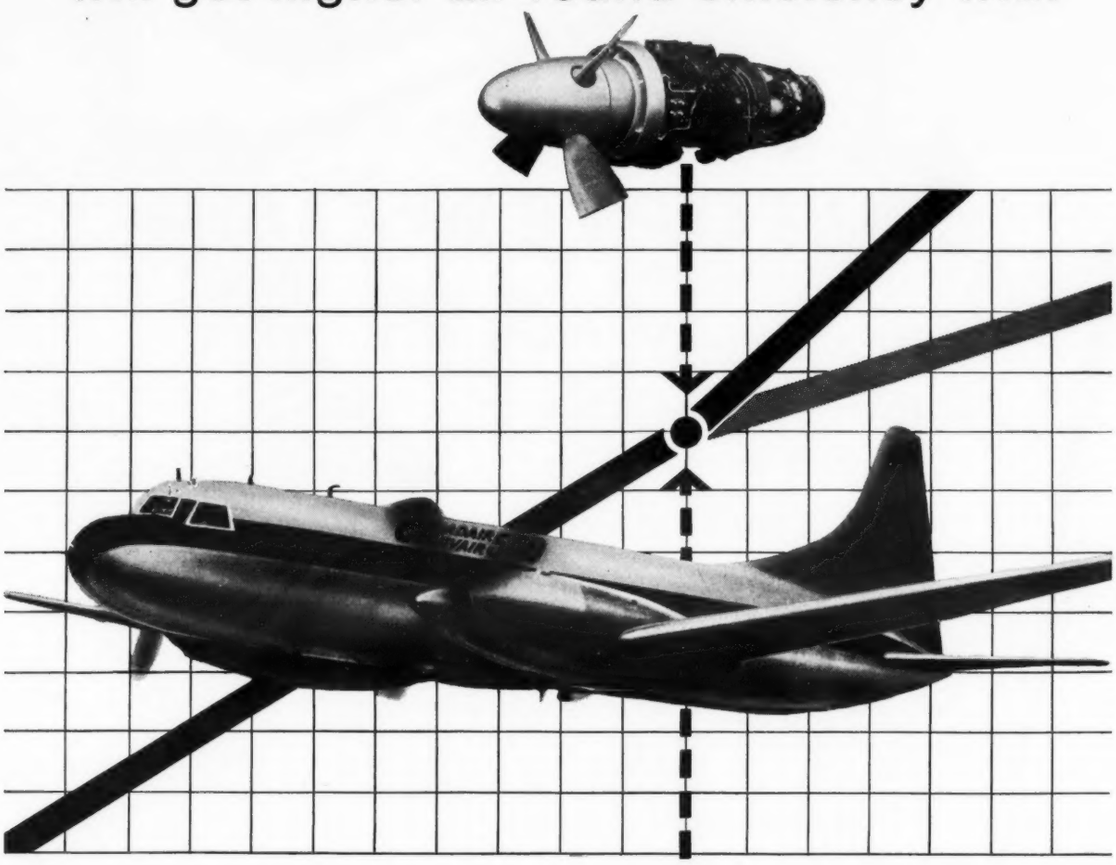

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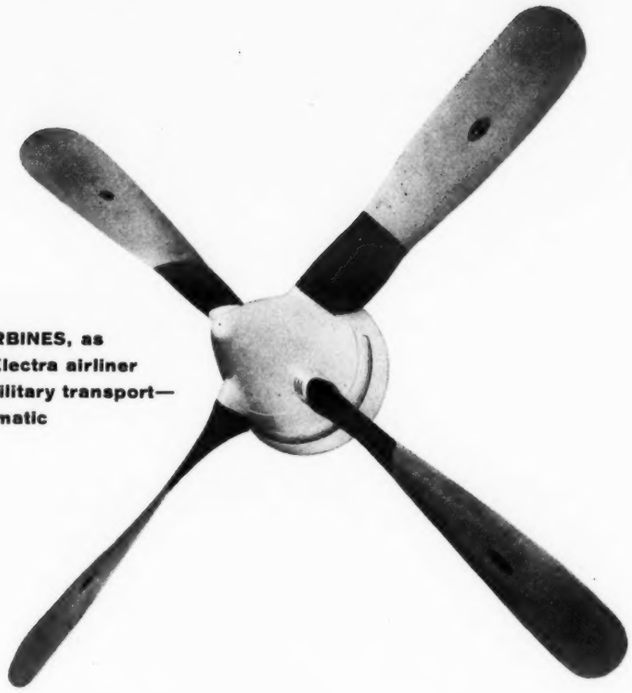

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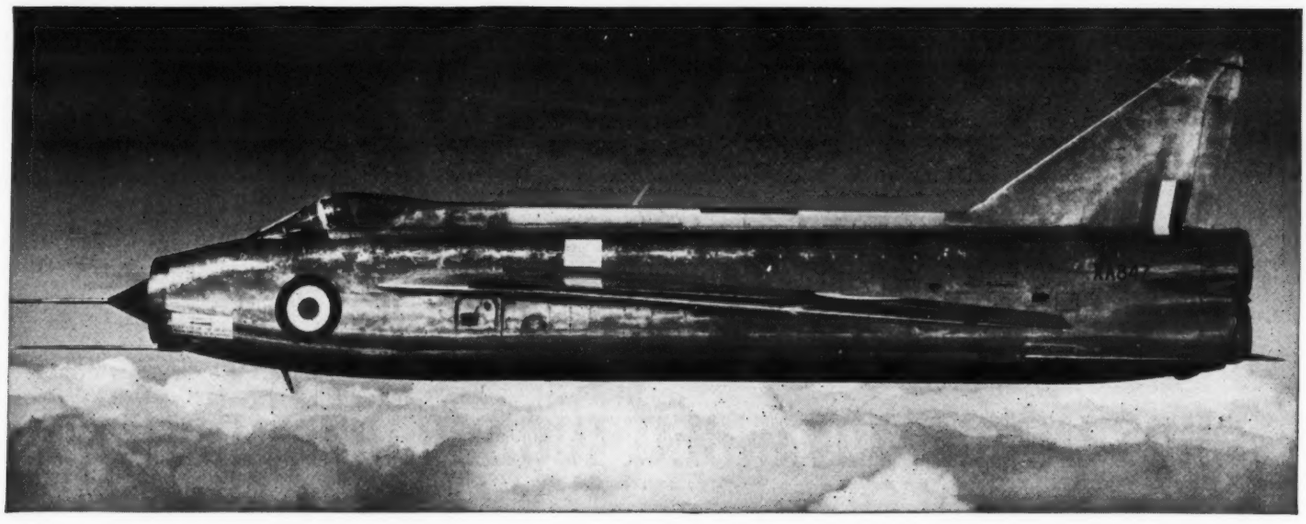

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The Golden Jubilee of the Paris Air Show

The story of the Paris Air Show is the story of aviation. The first Air Show, a display of free balloons and string-and-sealing-wax contraptions, was held at the Grand-Palais in 1909. Fifty years later, between June 12th and 21st, 1959, Paris–Le Bourget Airport opened its vast halls and landing areas to an international aviation and astronautics exhibition whose size and success must have surprised even the organizers themselves.

The great exhibition hall, built in 1952, had to be enlarged. On the runways stood more than a hundred fixed-wing aircraft and helicopters of all sizes for applications of every kind, and near the main entrance was a special display of guided missiles and space vehicles of all calibres. Finally, one of the airport hangars was rigged up as an "astronautical hangar"—evidently as a last-minute emergency measure—to house the USAF's "Aerospace Power for Peace" exhibit. In the two permanent exhibition halls, reaching as far as the eye could see, was a collection of piston and jet engines, aircraft parts and accessories, instruments and electronic ground and airborne equipment ... in short, all that the heart of pilot or engineer could desire.

That 14 nations exhibited their products at the 23rd Paris Air Show was no novelty, for the same number had taken part in the 1957 Air Show. This time, however, international participation was no symbolic gesture, no mere formality, for America and Britain, Italy, the Netherlands and Sweden came forward with

Max Holste (France) showed the prototype of the MH.250 *Super Broussard* piston aircraft. The production version, the MH.260, will have two Turboméca *Bastan* propeller turbines and be capable of transporting 17 to 26 passengers.

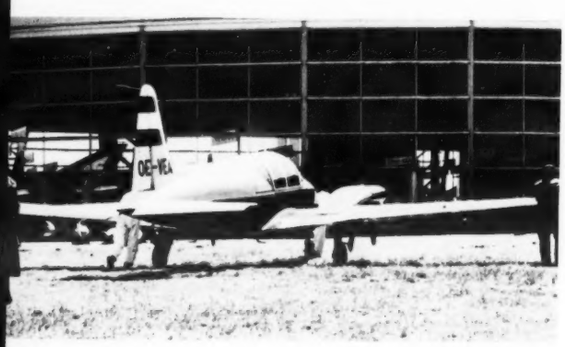
The American Aero Design & Engineering Co. *Commander 680E* (two 340 h.p. Lycoming engines) was flown across the Atlantic by Miss Jerrie Cobb to take part in the Paris Show.

French Morane-Saulnier MS.1500 *Epervier* multipurpose two-seater (750 h.p. Turboméca *Bastan*) for ground support.

The Czechoslovak L.60 *Brigadyr* multipurpose four-seater (220 h.p. Praga engine) with agricultural equipment, demonstrated by Omnipol.

Shown by Bölkow Entwicklungen KG of Munich: Klemm Kl. 1070 touring four-seater (150 h.p. Lycoming engine).

A masterpiece of the Italian industry: Macchi MB.326 two-seat military trainer powered by a Bristol-Siddeley *Viper II* jet.



The Austrian Simmering-Graz-Pauker AG Meindl M.222 touring four-seater (two 150 h.p. Lycoming engines) taxiing along the runway...

...and meeting the Swiss Pilatus *Porter* light transport aircraft (340 h.p. Lycoming engine) returning from its demonstration flight.

their newest developments, and Russia and Czechoslovakia did not lag behind. Poland, unfortunately, was not represented, but Switzerland and Austria had sent to Paris models of their own design. There were a good 300 exhibitors in all. Aviation experts came from all countries and there were some 650,000 visitors from the Paris region, of whom 300,000 were present on the two flying days alone. Traditional Parisian interest and the cash receipts taken showed that financially, too, the exhibition had been a success for the organizers, Union Syndicale des Industries Aéronautiques.

Henri Desbruères, the dynamic President of the Jubilee Air Show, had every reason to be pleased with the results. Although, contrary to time-honoured custom, the Show was not opened by the President of the Republic, General Charles de Gaulle came early the next day, June 13th, to show his interest in aviation and more particularly in astronautical matters.

The leaders of the French aircraft industry are to be congratulated. About a year ago France was in the throes of a political and financial crisis which gave the industry, dependent as it is on State support, the gravest cause for concern. When the new de Gaulle Government succeeded in stabilizing the political and financial situation the industry's hopes began to rise and it reacted with characteristic Gallic buoyancy and resourcefulness. Commercial jet aircraft, supersonic fighters and bombers, guided missiles, helicopters of all sizes, engines in all performance classes, accessories and electronic equipment, were neatly ar-

The Italian Agusta Z.8L short range transport for 22 to 26 passengers (four 520 h.p. Alvis engines) takes to the air...

...and the German Dornier Do 28 four-to-six seat STOL aircraft (two 180 h.p. Lycoming engines) flying on one engine.

America's "flying farmer", the Grumman *Ag-Cat* agricultural single-seater (220 h.p. Continental engine), was the only biplane in the 1959 Air Show.

Another "flying farmer", this time from Great Britain: Lancashire Aircraft Corporation's *Prospector*, formerly the E.P. 9 (295 h.p. Lycoming engine).

Italian Aviamilano F. 14 *Nibbio* touring four-seater (180 h.p. Lycoming engine).

Italian Piaggio P. 166 touring six-seater (two 340 h.p. Lycoming engines).

French Sipavia S.26L *Anjou* touring five-seater (two 180 h.p. or 250 h.p. Lycoming engines) shown by Société Industrielle pour l'Aéronautique.

French Wassmer WA. 40 touring four-seater (180 h.p. Lycoming engine).

ranged to catch the eye of the potential customer. Governing all minds was the concept of a *loi-programme*, a work schedule for the aircraft industry laid down by law. It is now up to General de Gaulle, Prime Minister Debré and Finance Minister Pinay to see that the industry is not disappointed in its hopes.

*

It might be appropriate at this point to say a few words about France's aircraft industry. In 1958 it employed about 85,000 personnel and 23,700 machines. Of the total personnel 55 percent were employed by the fourteen airframe constructors, about 19 percent by the seven engine builders, another 19 percent by equipment manufacturers, and the remaining 7 percent were accounted for by the aviation departments of the electronics companies. The estimated turnover for 1958 was 200 thousand million "light" francs, i.e. about 450 million U.S. dollars. And, what is highly significant, the whole industry is showing a tendency towards concentration.

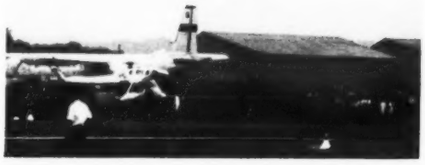
The reader can see what the French industry has to offer from a picture report to which this text is but the accompaniment. Though some of the newest, and in the editors' opinion the most representative, French models have been selected for illustration, it must be stressed that this survey in no way claims to be exhaustive. Below is a list of some French "surprises":

- The impressive take-off and landing performance of the Breguet *Intégral 940* experimental STOL aircraft. The production model, the 941, of which only a mockup was on show, gives

Breguet 1050 *Alizé* carrier-borne anti-submarine three-seater (Rolls-Royce *Dart*) in the shade of a Breguet 765 *Sahara* large-capacity transport.

The amazing Breguet 940 *Intégral* STOL aircraft (four Turboméca *Turmo* engines, each of 400 h.p., and high lift flaps) requires runways of less than 200 yards for taking off or landing fully loaded.

The French Dassault MD.415 *Communauté* twelve-seat small transport (two Turboméca *Bastans*) makes its public début.



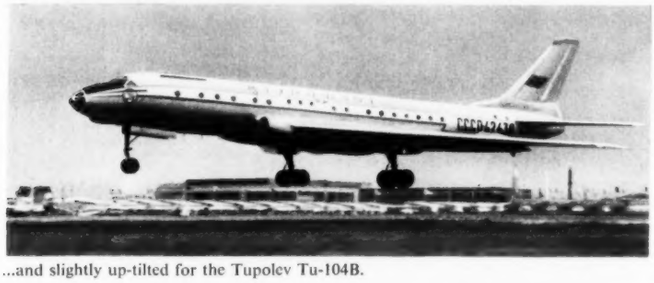
The Breguet 941, the production model of the *Intégral* (seen here in mockup form), will be powered by four 1,014 h.p. de Havilland *Gnome* propeller turbines and will take up to 48 passengers or freight.

A guest from the "golden West": Cessna T-37A jet trainer (two Continental jets, each of 925 lb thrust) for the basic training of USAF military pilots.

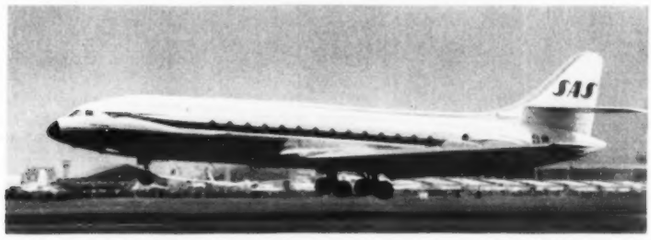
promise of even better performance by virtue of its considerably higher-powered propeller turbines. This aircraft, with the Sud-Aviation *Caravelle*, is evidence of the great advances made by France in the construction of commercial aircraft.

- Fly-past of the Dassault *Mirage IV*. Reportedly this prototype will be followed by a longer-range production version, of which a batch of about 60 is to be built. The *Mirage IV* is proof that France is fully equipped to deal with the complicated research problems of supersonic aircraft.
- The rocket-like climb of the Nord *Griffon* experimental aircraft, the only ramjet-powered manned aircraft in the world.
- The Sud-Aviation *Frelon*, a three-turbine helicopter for 25 passengers.
- The Hélicop-Air *Girhel*, which could lead to a renaissance of the autogyro.
- The improved Dassault *Mirage IIIA* and *IIIB*, with thin wings, higher-powered reheat jet engine and SEPR rocket motor, with complete weapons and instrumentation.
- The versatile Morane-Saulnier *Epervier* strike aircraft, a new answer to the problems of bush warfare with its heavy military load.
- Dassault *Etendard IV* transonic single-seat naval strike aircraft for French carriers of the Clemenceau class.
- The Dassault *Communauté*, a highly successful turboprop touring twelve-seater whose strike version, the *Spirale*, carries similar weapons to the Fiat G.91 NATO strike fighter.
- Many new sports and touring aircraft by Morane-Saulnier, Sipa, Wassmer, Scintex and others.

Typical landing attitudes... Nose always slightly down for the Ilyushin Il-18...

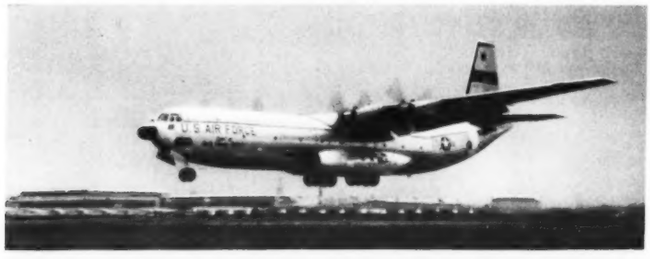


...and slightly up-tilted for the Tupolev Tu-104B.



Sud-Aviation *Caravelle* (in SAS colours)...

Vickers *Vanguard* (BEA)... and Douglas C-133 (MATS) touch down almost horizontally.



The French Nord 2508 military transport (two Pratt & Whitney R-2800s) banks with its main engines stopped, powered only by its two Turboméca *Marboré* auxiliary jets.

Some details of the largest military transport in the western world, the Douglas C-133: Four Pratt & Whitney T34 propeller turbines, each of 6,000 h.p.; two AiResearch (GTU) auxiliary turbines aft of the left wheel well; wing span 179 ft 8 in; largest payload ever carried about 50 tons. Dimensions of side loading door 8 ft 4 in × 8 ft 10 in.

To the disappointment of a few optimists, the demonstration of the *Coleopter* forecast in the non-French technical press did not take place. Perhaps more money was invested in this much-publicized annular-wing design than it really deserved. At any rate, the French and German authorities responsible for its development have probably been forced to the conclusion that this design, seemingly so full of promise five years ago, has been surpassed by the more recent VTOL aircraft which take off in normal flying position.

Surprises from other countries

Great Britain showed a Blackburn NA.39 two-seat naval strike aircraft of impressive size and design for carrier-based low-level attacks behind the enemy's lines, the new A.W. *Argosy* high-speed freight transport and the English Electric P.IB *Lightning* supersonic fighter which is to be standard equipment for British fighter units for some time to come.

As expected, *Italy* displayed the Fiat G.91, armed to the teeth with strike weapons. The new Macchi MB.326 seems to be a likely competitor to the French Fouga *Magister*. And the Agusta 102 helicopter is proof of the manufacturer's ability to develop original designs.

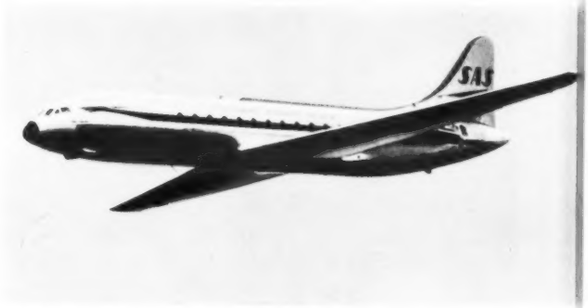
Sweden demonstrated her Saab *Draken* (J35) supersonic fighter in a manner which cannot fail to arouse genuine interest among foreign air forces with enough funds to spare.

Czechoslovakia had five aircraft on show: the *Morava*, the *Meta-Sokol*, the *Trener-Master*, the *Brigadyr* and the *Aero 145*. — *Canada* was represented by the Canadair-Convair 540 twin-

The British Vickers *Vanguard* transport aircraft (four Rolls-Royce *Tyne* engines) for about 100 passengers.

The RAF Bristol *Britannia 253* long range transport (four Bristol *Proteus 755*) for up to 115 men or supplies.

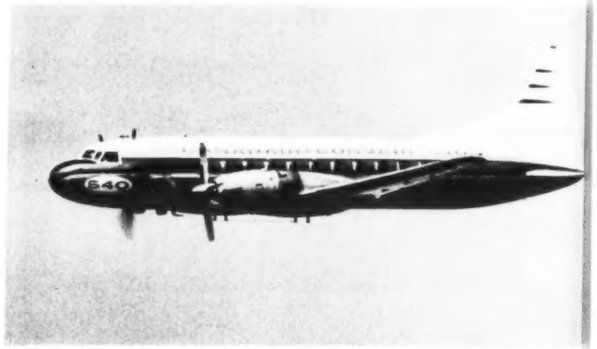
British Armstrong Whitworth AW.650 *Argosy* freight transport (four Rolls-Royce *Dart* engines) for 13-ton payload.



A Sud-Aviation *Caravelle* in SAS colours flies past.

American Lockheed C-130 *Hercules* assault transport (four Allison T 56) for 92 men.

The Canadian Canadair-Convair 540 turboprop transport (two Napier *Elands*), developed from the *Metropolitan*.



The giant Russian Tupolev Tu-114 (four propeller turbines of 12,000 h.p. each) is said to carry 220 passengers and is one of the largest aircraft in the world.

engined commercial aircraft. — *The Netherlands* sent the Fokker *Friendship* and the *Kolibrie* ramjet-powered helicopter. — *Belgium*, not to be outdone, manoeuvred the "world's smallest aircraft", the one-seat Fairey *Nipper*, through the throng of large transports on the airfield to demonstrate it in flight.

Unlike Belgium, the *USSR* showed only heavy-weight aircraft, such as the Tu-104B, the well-appointed Il-18 *Moskva* with its battery of instruments, and the Tu-114, civil version of the *Bear* long-range bomber, one of the largest aircraft in the world with its four 12,000 h.p. turboprops.

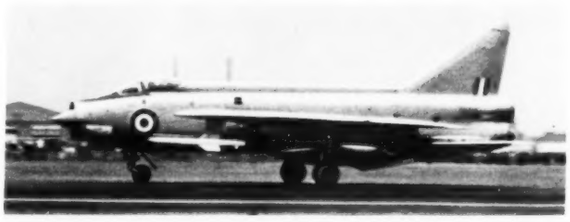
Spain exhibited engines, *Austria* the Meindl 222 sports aircraft. *Switzerland* emerged from her seclusion to present two models by Pilatus Aircraft Works, a member of the Oerlikon group: the P.3 standard trainer and a new model, the CP-6 *Porter* light transport aircraft, with an equipped weight of only 2,400 lb. but a useful load of 1,540 lb. It would not be fair to pass over in silence the *Federal Republic of Germany's* effort, particularly that of Bölkow-Entwicklungen KG, whose Bö 102 heli-trainer and its derivative, the Bö 103 single-seat helicopter, are worthy of special mention.

All this, however, pales in significance beside the contribution of the *United States* aircraft industry and Air Force. The USA obviously thought Paris worth the effort, and gave most convincing proof, not only of its commitments towards the West, but

Above: British Blackburn NA. 39 two-seat naval strike aircraft, powered by two de Havilland *Gyron Junior* jets; *Below:* the Hawker *Hunter* two-seat ground attack aircraft, powered by a Rolls-Royce *Avon* jet.

The record-breaking French Nord 1500 *Griffon* (SNECMA *Atar* plus ramjet duct).

English Electric P.1B *Lightning* supersonic fighter (two Rolls-Royce *Avon* engines) in full battle array.



USAF McDonnell RF-101 *Voodoo* armed high-altitude reconnaissance aircraft takes off with a deafening roar (two Pratt & Whitney J57s with short afterburners).

Landing

Dassault *Mirage III A01*...

...and *Mirage III A05* (with radar nose).

Saab J35 *Draken* (Sweden) and

Convair F-102A *Delta Dagger* (USA).

also of its interest in the European market, in the shape of the giant Douglas C-133 transport with its wing span of 179 ft. 8 in., loading hatches the size of barn doors and a payload of up to 90,000 lbs.; the Lockheed C-130 *Hercules* assault transport, which the manufacturers are offering for construction under licence in Europe, with apparent prospects of success; the new medium-sized Sikorsky S-62 and Vertol 107 helicopters, of which larger versions are already in preparation; and finally, smaller helicopters built by Hughes, Bell and Doman.

Then there was the Century series of fighters, the F-100, F-101, F-102, F-104, which, with their afterburners in operation, were the loudest of any in the whole show, the Boeing B-52 bomber, which passed over Le Bourget exactly as planned on a non-stop flight from New Mexico via Alaska to Europe, and finally the *pièce de résistance* of all USAF flying displays, the Skyblazer Team of five F-100 fighters.

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It would be a mistake to try to squeeze an appraisal of the guided missiles and astronautical exhibits into this brief survey. In the next article, "The Missile Show—Europe–USA", the reader will find an outline of the European and American developments which marked the Paris Jubilee Show as the "first astronautical exhibition".

*

Rotorcraft parade

British Fairey *Rotodyne* VTOL passenger transport aircraft (two Napier *Elands* plus four blade-tip combustion chambers)...

...and Westland *Westminster* heavy helicopter (two Napier *Elands*).

Italian Agusta 102 helicopter (610 h.p. Pratt & Whitney engine) for ten passengers.

Sud-Aviation's three small helicopters, front to back: *Alouette III* seven-seater (Turboméca *Artouste IIIB*); *Alouette II* five-seater (Turboméca *Artouste II*); *Djinn* two-seater (Turboméca *Palouste*)...

...and the SE.3200 *Frelon* 25-seat heavy helicopter built by the same manufacturer (three Turboméca *Turmo* engines).

The American Sikorsky S-62 ten-seat turbine-powered helicopter (two General Electric T-58s) lands at its private seaplane station, an artificial lake on the airfield.

Objectivity demands that not only the high spots of the Paris Air Show, but also some of its less desirable features be mentioned.

Admittedly there were no external hitches in the organization. The stands were ready for the opening on June 12th. A French Air Force guard of honour in full dress had arrived to greet Defence Minister Pierre Guillaumat, foreign guests and French notables with a fanfare of brass. The halls had been enlarged and improved; the long rows of reception pavilions of the major French and foreign constructors were a tasteful variant on those in which the British aircraft industry welcomes its guests to Farnborough; and how the Union Syndicale managed to get 5,600 people into the largest hangar in Le Bourget and feed them all on hors-d'œuvres, cold chicken, dessert, red and white wine, coffee and liqueurs, will always remain a mystery. The organizers deserve full credit for all this.

On the other hand . . . A British reader writes: " . . . It seems to me high time that the organizers of the Air Show set aside one or two full days for aeronautical technicians, air force representatives, buyers and other interested parties. It is extremely difficult for exhibitors to separate the wheat from the chaff and avoid an invasion of their stands by school outings, fiancées and babies just when they want to talk to their customers. The two most suitable days for the trade would naturally be the last Thurday and Friday, just before the air displays, when all the aircraft have already arrived and the important visitors are certain to be

U.S. Hughes 269A two-seat helicopter (180 h.p. Lycoming engine).

Bölkow Bö-102 single-seat trainer helicopter (40 h.p. Ilo engine).

French Hélicop-Air *Girhel* two-seat autogyro (90 h.p. Continental or 150 h.p. Lycoming engine).

U.S. Doman LZ-5 eight-seat helicopter (400 h.p. Lycoming engine).

American Vertol 107 turbine-powered transport helicopter (two Lycoming T 53s).

Mockup of the Sikorsky S-61 25-seat turbine-powered transport helicopter now under development (three General Electric T58s).

The U.S. Army's Bell HU-1 *Iroquois* helicopter (Bell 204) with Lycoming T53 gas turbine.

present. Perhaps you could put forward this suggestion in a suitable form . . ." This has now been done.

To show readers that there is something in what our friend says, a picture reproduced here gives an idea of some aspects of the Air Show which are against the best interests of the organizers:

Comparison between a large and a small transport: Parisians sheltering from the sun beneath the undercarriage of a giant Russian aircraft. Observe the contented smile of the paterfamilias. For him a Tupolev is as good as an Ilyushin; he has eyes only for his child. In the background stands the rest of his brood, fresh from a tour of the exhibition halls where they have collected a goodly store of technical brochures intended by the exhibitors for their customers.

But no purpose is served by going to the opposite extremes. Another picture shows the roped-off pavilion of the Association

Paris 1959

The one and only appearance (on June 20th, 1959) of a Boeing B-52E *Stratofortress* of the USAF Strategic Air Command, which flew over Le Bourget airport on the way from New Mexico via Alaska to Britain exactly as scheduled.

The USAF Tactical Air Command demonstrated the in-flight refuelling of a mixed bunch of aircraft: the McDonnell F-101 *Voodoo* (left, shortly before making contact), the Douglas B-66 *Destroyer* (centre) and the North American F-100 *Super Sabre* (right) are being refuelled from a Boeing KB-50 by the probe and drogue method. A high degree of skill on the part of the pilots is required to match the speeds of four such different types of aircraft.

Rapid fly-past of the *Mirage IV-01* (two SNECMA Atar 9s; prototype of a supersonic bomber weighing over 50 tons) accompanied by a *Mirage III* supersonic fighter.

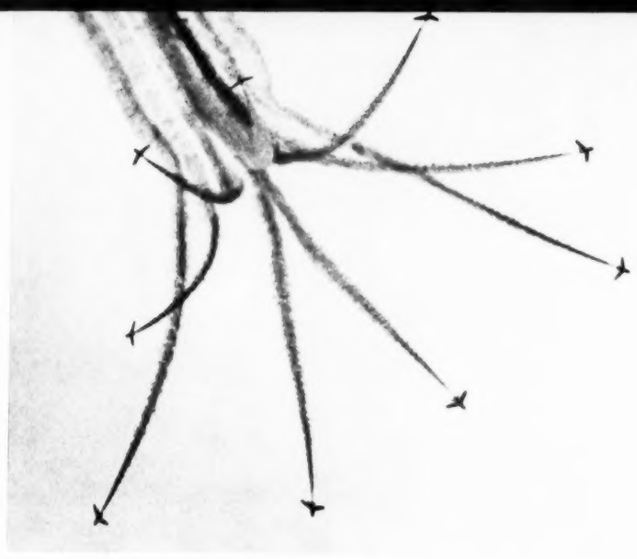
The RAF's Avro *Vulcan B.1* bomber landing.

The Royal Air Force presents its visiting cards: the Handley Page *Victor B.1* four jet bomber (in front) and the Avro *Vulcan B.1*.

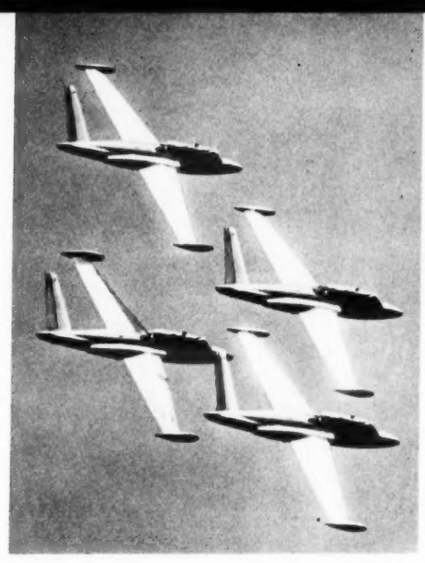
The U.S. Military Air Transport Service's first VIP transport: the Boeing VC-137A (special version of the Boeing 707).

The Lockheed F-104B two-seat *Starfighter* was the only supersonic aircraft in the Show to arrange demonstration flights for visitors showing a "genuine interest" in the aircraft.

Two-seat version of the rocket-armed Dassault *Mirage IIIB* supersonic fighter with a Nord 5103 air-to-air missile under its fuselage.



Final salute of the *Patrouille de France* (Dassault *Mystère IV*).



An outstanding display of aerobatics by the French *Ecole de l'Air* (Fouga *Magister*).

The USAF *Skyblazer* patrol (North American F-100).

Morane-Saulnier MS.760 *Paris* jet trainers, flown by French air force pilots.

The leaders of the RAF aerobatics team (Hawker *Hunter Mk.6s*) shortly before take-off.

Fraternization in the shade of the Fokker *Friendship*... over Coca-Cola and sausages.

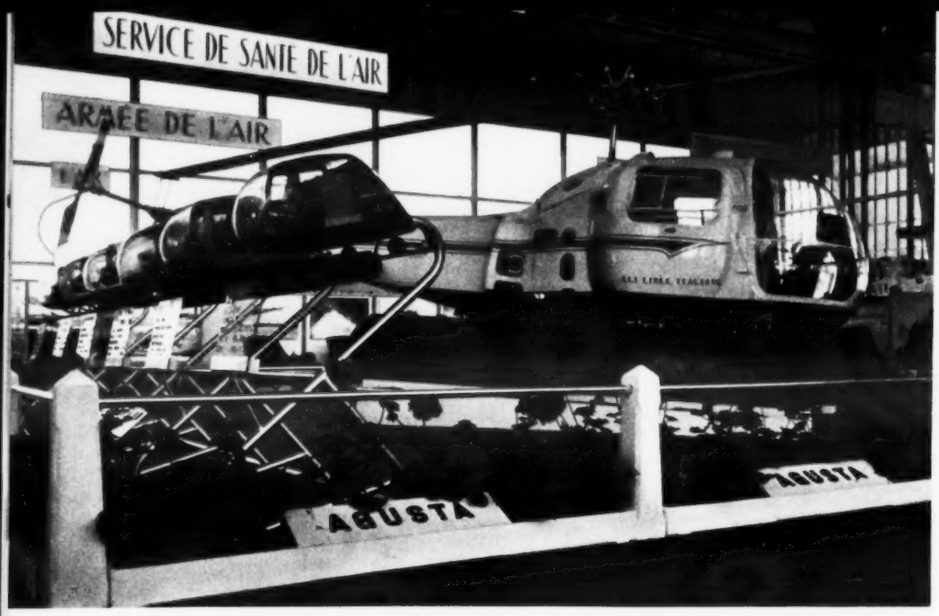
Patrouille de France formation of nine.

of German Aircraft Manufacturers. In the foreground is an attractive young girl, and next to her, in a position which cannot be overlooked, a placard with the words: "SEULEMENT POUR NOS CLIENTS"—"Customers only", evidently meaning the Federal Minister of Defence, so far the German aircraft industry's only customer. Is this hospitality?

A further criticism: We feel that a change of caterer for the exhibition restaurant is strongly recommended. The exhibition staff, who are on the stands for ten long, hot hours, have a right to better value for their money. We would also welcome the organization of a system for preventing schoolchildren and trippers from swarming over the stands, touching exhibits and collecting leaflets which will be thrown onto the street after they leave the show.

These may be merely incidental matters, but they can nevertheless have a considerable effect on the orderly running of a large exhibition.

And now a word on the flight displays: As is usually the case in Paris, the timing of the displays on the two flying days was exemplary. As for the demonstrations themselves, the spectators had almost too much of a good thing; there were 110 items on the programme, which lasted from a quarter to ten in the morning until a quarter to seven in the evening, and there were many dead moments apart from the midday break. If exhibitors had been content to demonstrate only the newer models, their performance would have appeared in a better light and would not have been obscured by items of purely incidental interest. Spectators were consoled by the outstanding formation flights of the



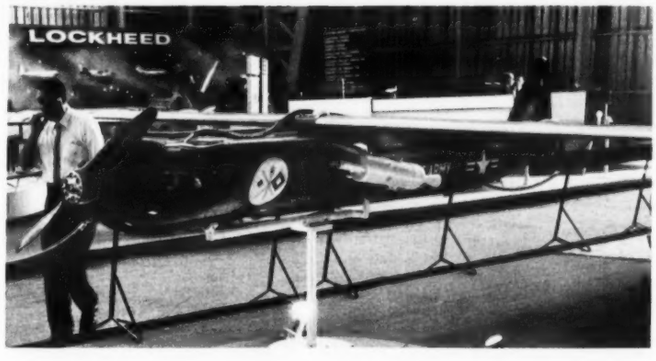
Agusta-Bell 47J four-seat helicopter and models of various export versions on the Costruzioni Aeronautiche Giovanni Agusta stand.

Paris 1959

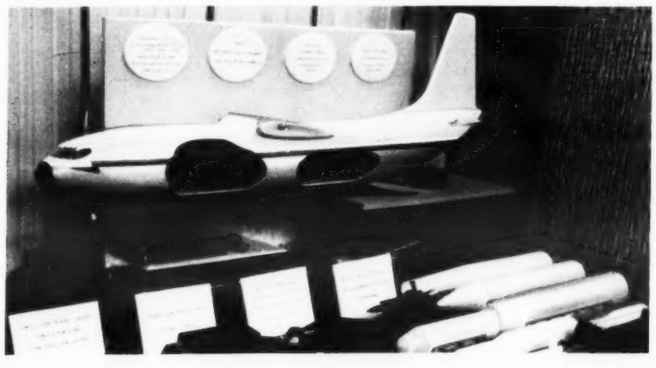
The Fairey *Nipper* single-seat sports aircraft, the smallest in the world, catches the eye on the joint stand of Groupement Belge de Constructeurs de Matériel Aéronautique (GEBECOMA).

Folland Aircraft Ltd. showed models of the single and two-seat *Gnat*, forerunners of the lightweight supersonic fighter and fighter trainer (thin wing, reheat engine, Mach 1.5) which is still under development.

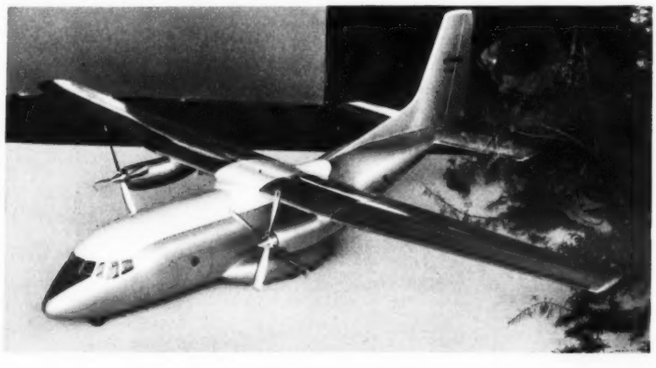
The Radioplane SD-1 remote-controlled reconnaissance aircraft. – Further attractions on the Northrop stand were the 0-4 supersonic target drone and models of the N-156F lightweight fighter.



Model of the RAF Short SC.5 *Britannic* 100-ton transport (four Rolls-Royce *Tynes*) and models of the freight it can carry: armoured and non-armoured vehicles, anti-aircraft missiles, heavy missiles up to a total weight of 38 tons. – With a reduced useful load the maximum range of the SC.5 will be 5,050 st. miles.



Model of the European *Transall C.160* assault transport (two Rolls-Royce *Tynes*) on Nord-Aviation's stand. Nord-Aviation will be manufacturing this aircraft, which is to weigh around 40 tons, in collaboration with Hamburger Flugzeugbau, Ingenieurbüro Blume and Weser Flugzeugbau.



Patrouille de France, the *RAF Team* and the American *Skyblazers*.

Perhaps those responsible for arranging the displays had the same feelings that evening and will make some cuts in the programme of the next Air Show.

All this does not make the whole exhibition in any way less admirable. The 1959 Jubilee Air Show was an international event such as has never been seen before in any air-faring country. The 23rd Paris Air Show provided a true cross-section of the latest developments in West and East and in neutral countries.

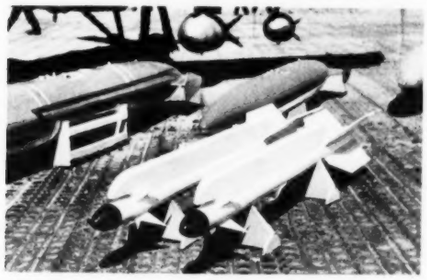
It was the first show which could claim to be an exhibition of aviation and astronautics. At the time of the 1909 Air Show the Frenchman Blériot flew across the English Channel, ten years later the Britons Alcock and Brown conquered the Atlantic, and now, in the Golden Jubilee year of the Paris Air Show, two artificial planets, one Russian, one American, are in orbit round the sun and numerous satellites are circling the earth.

Finally, to return to the host country, French science and technology are not lagging behind in this general development. If the French Government succeeds in giving its gifted designers a sound financial backing, we shall see the French industry make an unexpected come-back and can be sure that the Paris Air Show will continue to occupy a unique position in the international aviation calendar.

Weapons for Fighters and Strike Aircraft

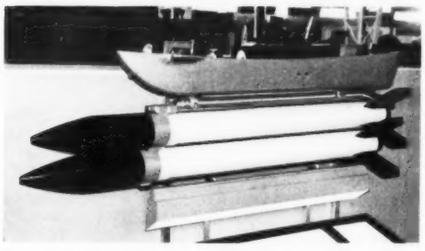
The static exhibition at Le Bourget left an enduring impression of the many kinds of weapons available for tactical jet aircraft and showed at the same time that individual weapons are becoming not only increasingly complicated, but also more effective. The tendency towards complicated weapons systems is evident even in rockets and bombs without nuclear warheads: however, the rise in production costs is justified by considerably higher accuracy and fire power. This short picture report calls to mind the fact, all too frequently forgotten at flight displays, that the role of a military aircraft is first and foremost that of a weapons carrier and that its mission may be considered successful only when the weapons, after release from their flying "launching pad", have fulfilled all the tasks they are called upon to perform.

Générale Aéronautique Marcel Dassault's JL 200 combined rocket launcher and auxiliary fuel tank. The capacity of the tank is 198 Imp. gall. and its nose contains 36 unguided missiles whose gas jets are led off via ducts into a ring-shaped system of outlets round the tank.



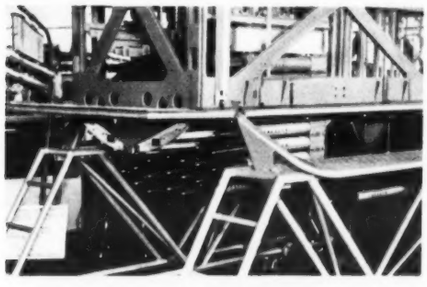
A new version of the U.S. Navy's Philco *Sidewinder* air-to-air missile with modified control and stabilization vanes and a choice of radar or infra-red homing head, is now to be used by carrier-borne fighters of the French naval air arm.

An impressive assortment of unguided air-to-air and air-to-surface missiles displayed below and in front of a *Hunter* two-seater. Launchers by Microcell Ltd.

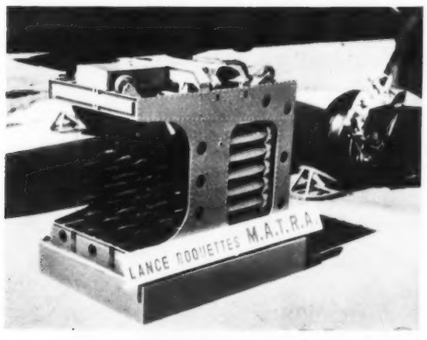


Two Type M.56 135-mm air-to-surface missiles with 9 lb. warhead (for impact speeds of about 650 m/sec) and unguided Type M.55 and M.57 75-mm air-to-air missiles shown by Bofors for the first time.

Above: Examples of the weapons and other external loads which can be carried by the Dassault *Etendard IV M*. To the right of the aircraft the picture shows (left to right): A Nord 5103 air-to-air missile, an auxiliary fuel tank of 181.5 Imp. gall. capacity, two Philco *Sidewinder* air-to-air missiles, another auxiliary tank, two MATRA rocket launchers, each with six T.10 rockets, and, behind, a napalm container. Suspended under the *Etendard IV M*'s port wing are two H. E. bombs. *Below:* The armament of the Fiat G. 91 strike aircraft is no less impressive: Nord 5103 air-to-air missiles, USAF 5-inch rockets, 3-inch rockets, napalm containers etc.



Above: MATRA 104 automatic rocket launcher for 112 68-mm rockets. Rate of fire of the launcher, which retracts into the fuselage of the SO.4050 *Vautour*, is 1800 rockets per minute. *Below:* A new MATRA retractable rocket launcher for 35 SNEB rockets (calibre 68 mm).



The Missile Show — Europe — USA

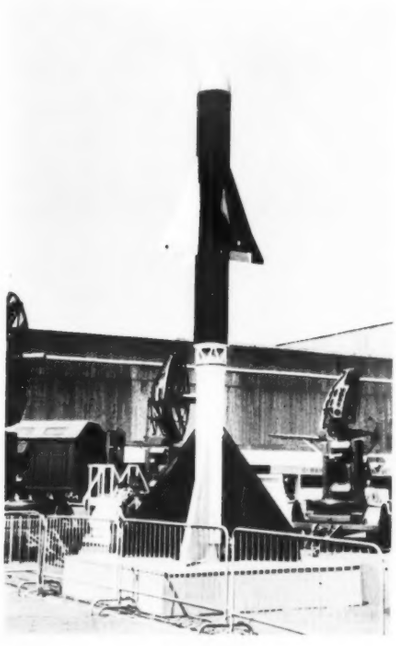
America's giant *Atlas*, *Thor-Able* and *Redstone* rockets overshadowed the hangars at Le Bourget and—visible from several miles away—impressively set their mark on the static exhibition. It had, of course, been foreseeable that missiles would play an important part in the 23rd Paris Show, but the size of the American exhibit outside the main building still came as a surprise. Aside from the huge rockets already mentioned, many of the American missiles on show have "favourable" export prospects. It is true that the planned deliveries of missiles to Europe will be made under inter-governmental arms aid agreements; nevertheless the U.S. manufacturers still considered it worthwhile to present their wares in Europe . . .

Yet the Americans are not likely to remain unchallenged for ever as main suppliers of missiles to NATO, as was revealed by a glance at the "forest" of rockets on the apron and even more clearly by a careful tour of the equipment stands. Whereas the United States in their modestly situated space exhibit (gondola for a high-altitude balloon, satellite equipment, mockup of the X-15) ventured to look into the future, the European exhibitors restricted themselves to today's missile arsenal. The missile business in Europe is now definitely under way, and countless equipment and accessories companies gave evidence that they have switched their production programmes to the missile market.

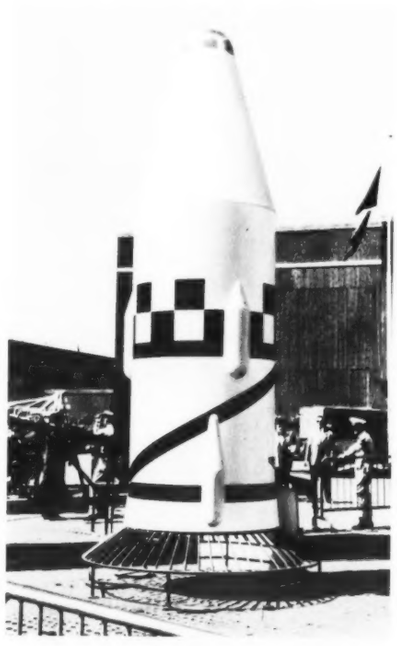
Brisk development activity can be observed in the French missile industry, revealing the existence of an entirely new weapons programme. As in Britain and the United States, the big airframe manufacturers are still holding their own in this new field, although in terms of sales figures they are far outdistanced by the electronics contractors.

It is obviously impossible, in the space available here, to discuss in detail the many different models exhibited by the missile manufacturers—who this year included Swedish companies for the first time. The present picture report gives only a cross-section of the weapons shown, and not only many well-known missiles but also a number of new developments have had to be omitted. Further details of individual designs will be given in forthcoming issues, with special attention to new European models. A survey of the power units for guided missiles is included in the article entitled "Motors for Guided Weapons" (page 969).

Sud-Aviation SE.4400 experimental surface-to-air missile. Launched by means of a solid-propellant booster, this vehicle is at present being used to test a new supersonic ramjet engine with multi-shock diffusor. Launching weight 2,640 lb, overall length 23.6 ft, max. speed Mach 3.6, ceiling 30 miles.



The USAF brought a mockup of its *Discoverer* satellite to Paris. The nose cone on the conical forward portion represents the recoverable container; the bulges on the cylindrical portion are covers for vernier rockets and gas exhaust apertures.



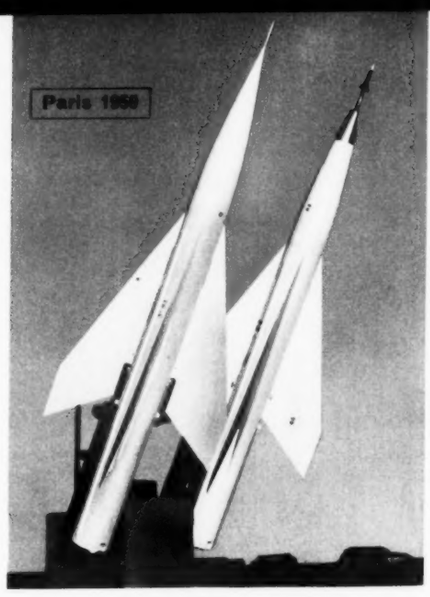
The Martin TM-76A *Mace* tactical missile (for ranges of around 600 miles) was presented by the U.S. Air Force as a complete, production weapons system. The Martin stand in the main exhibition building also provided information on the ATRAN radar-controlled photo-electrical programme guidance system for the TM-76 and on the *Titan* ICBM.

Missiles for the air defence of Western Europe and the United States: right to left: the U.S. Army's Douglas *Nike Hercules* and *Nike Ajax* surface-to-air rockets (both on their standard launching pads). To the left of the *Bomarc* is a four-stage high-altitude research rocket from France's ONERA (speed on burnout Mach 7) and in the rear, between the *Bomarc* and the ONERA rocket, France's MATRA 422 anti-aircraft missile. Rear right, the U.S. Army's *Redstone* tactical surface-to-surface weapon.

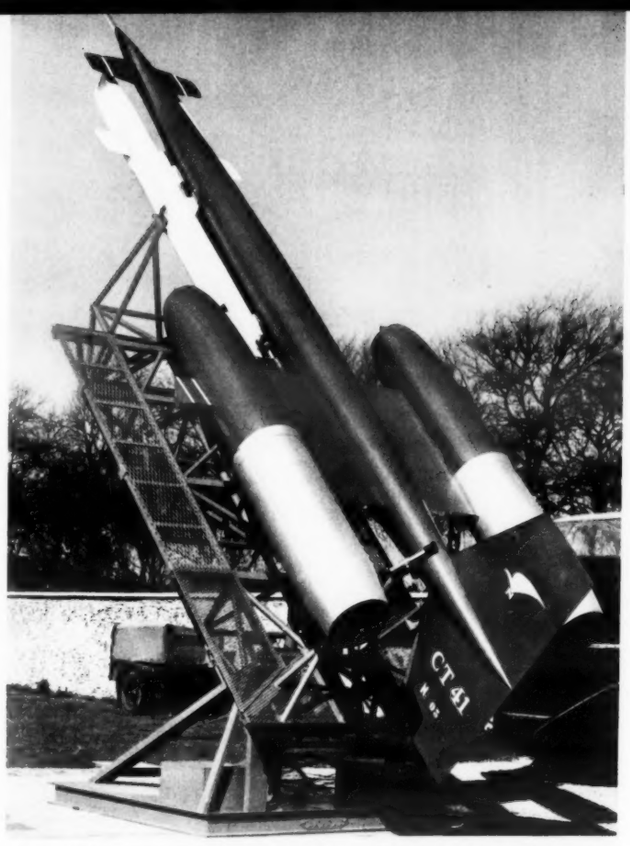
One of the pillars of Britain's air defence will be the Bristol *Bloodhound* surface-to-air missile, seen here with four boosters on its fixed standard launching mount.

The English Electric *Thunderbird* anti-aircraft missile was originally developed as a mobile air defence weapon for the British Army and is now being offered to Britain's NATO allies. Its four-legged carriage is attached to two single-axle vehicles for travelling purposes: this ensures rapid change of position.

European air defence – with American-designed missiles: a group of European companies is planning the licence production of the Raytheon *Hawk*, a weapon for use against high-speed, low-level raiders. The *Hawk's* triple launcher is mounted on a mobile two-wheel chassis and can be very rapidly prepared for action.



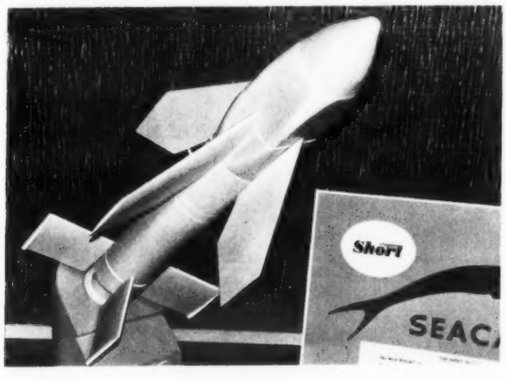
Nord-Aviation has been quietly going ahead with development of a surface-to-air missile with a range of nearly 10 miles, which can be roughly compared to the American *Hawk* in launching weight (1,050 lb) and max. speed (more than 2,000 f.p.s.). Known as the ACAM 5301, it is derived from the well-known Nord 5103 air-to-air weapon and has a warhead weighing 88 lb: length is 14.75 ft.



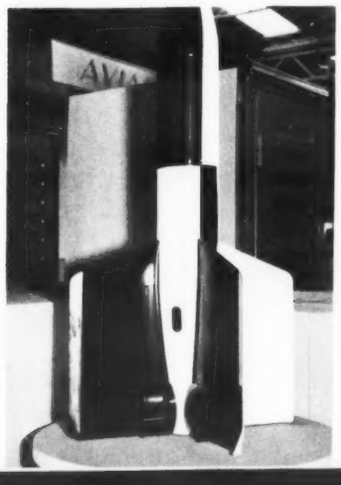
A new design from Nord-Aviation: the CT.41 target drone with two Nord *Sirius I* ramjets. The 32-ft missile is launched from an erecting ramp with the aid of a dual rocket booster. Later the nose cone is ejected, and the two portions are recovered separately by parachute. Main data: climb to 65,500 ft in roughly 80 sec; operational speed Mach 1.5 to 2.5: launching weight 5,600 lb: weight without boosters 2,860 lb.

Above, six Nord-Aviation SS.11 anti-tank missiles on a field trailer. Behind, four SS.11s on a special carriage in front of the gun turret of an AMX-13 tank. *Below*, the new Nord-Aviation SS.12 multi-purpose missile (right) with large warhead on its launching rig. The SS.11 missile alongside reveals its comparative size.

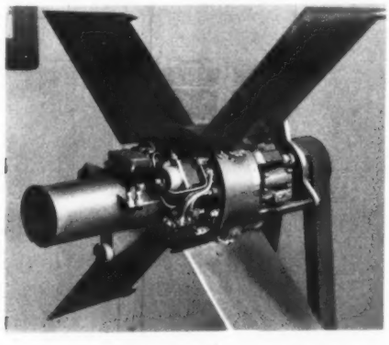
The Short *Seacat* solid-propellant missile for shipboard use, shown in public for the first time. As successor to the Royal Navy's Bofors 40-mm anti-aircraft guns, the *Seacat* is designed for short-range operation against raiders breaking through the barrage of long-range anti-aircraft weapons.



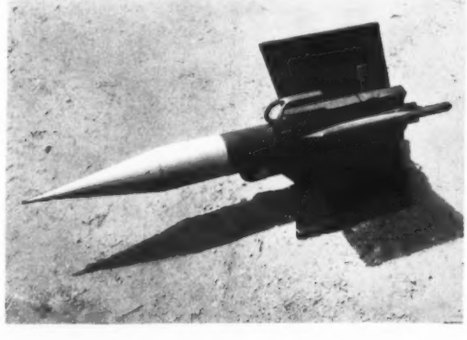
Sweden's Bofors concern has also developed a one-man anti-tank missile (designation *Bantam*) with hollow charge and spoiler controls at the rear of the cruciform wings. Missile length 31.5 in., launching weight 13.2 lb, weight including transport and launching container 19.8 lb, speed 260 f.p.s.



An interesting idea of the structure and accessories of the Armstrong Whitworth *Seaslug* ship-borne anti-aircraft rocket was given on the company's outdoor stand, where this picture of the cruciform wing with control motors and parts of the guidance system was taken.



Type 810 wire-controlled anti-tank missile developed by Bölkow-Entwicklungen KG for one-man operation over distances of 500 to 1,600 yards. Weight of missile (including roughly 5.5 lb warhead) 20.9 lb, weight of control unit 4.85 lb and of transport container 8.8 lb; average speed 280 f.p.s.



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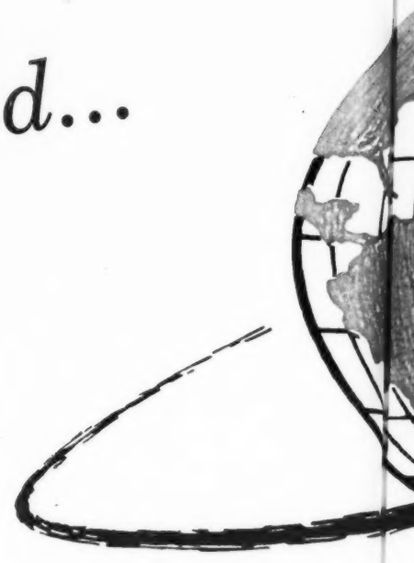

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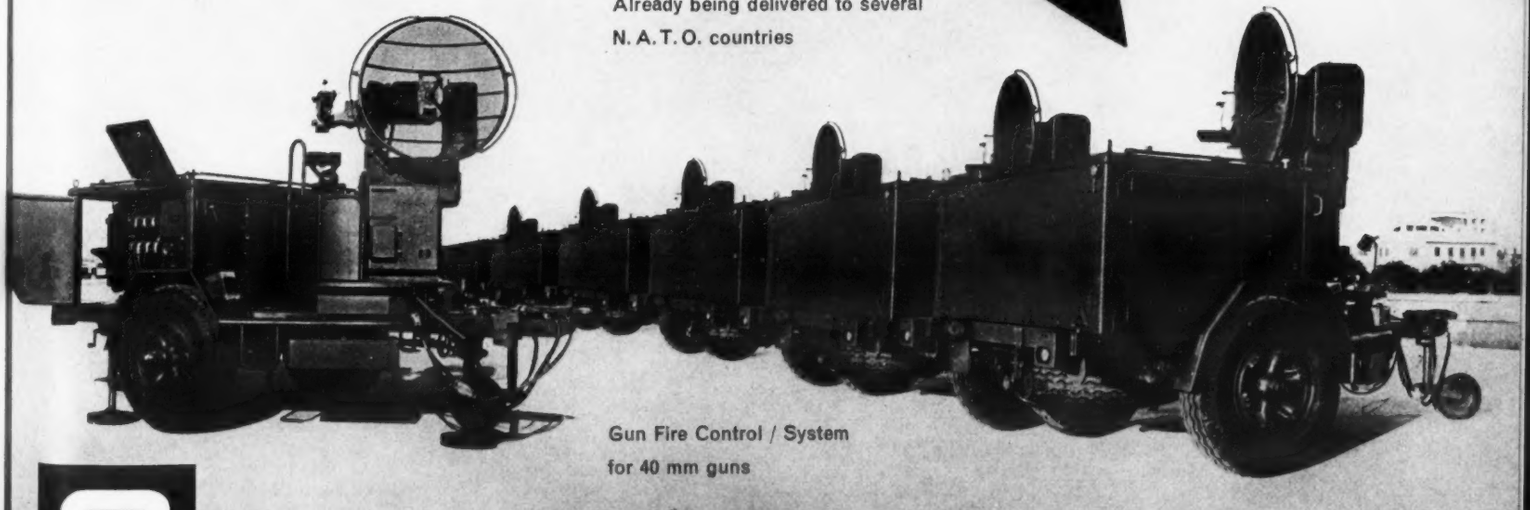

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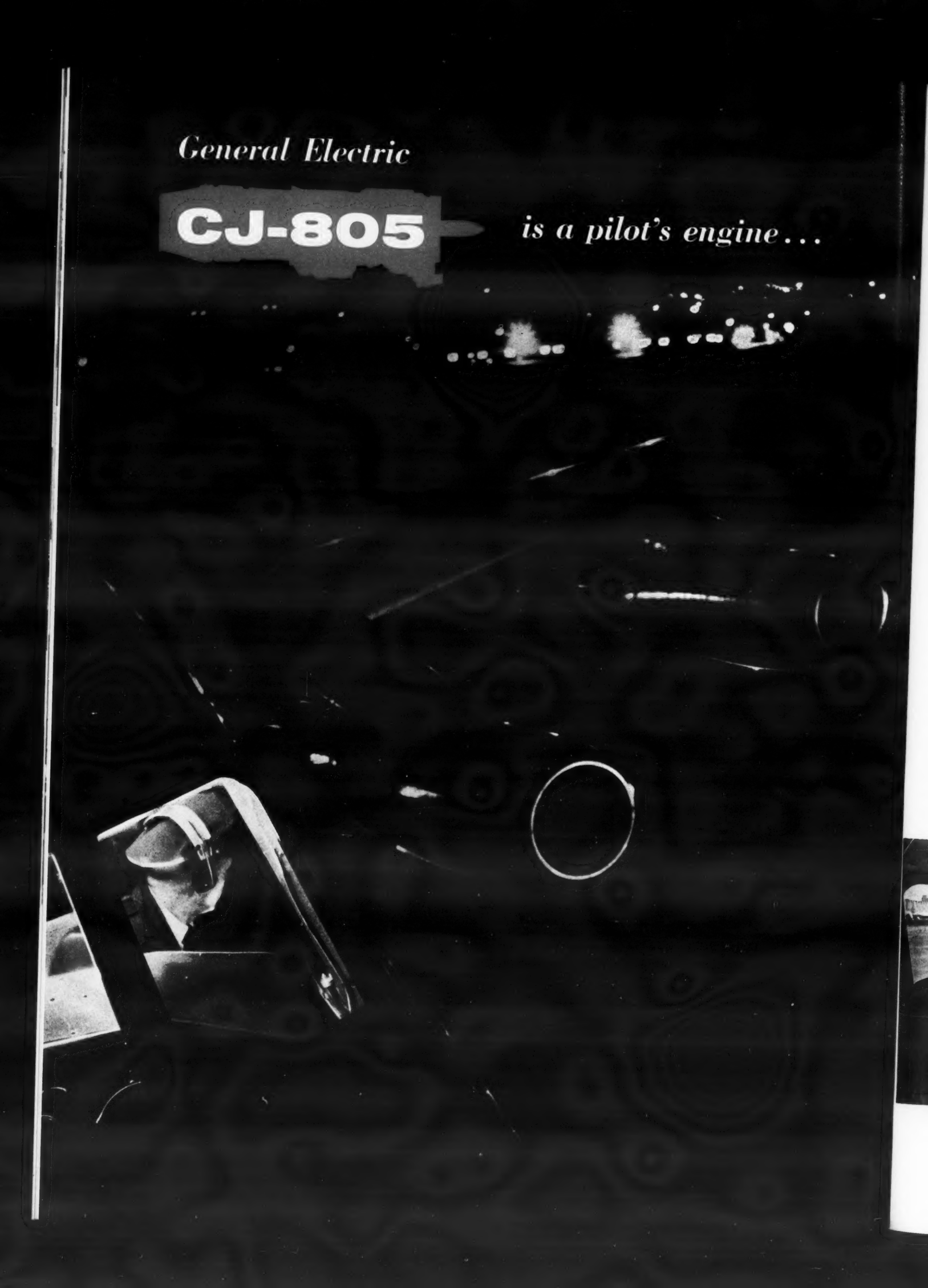
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CJ-805 Maturity—CJ-805 production engines, identical to those flying on CV-880s, have already demonstrated ruggedness and maturity in thousands of flight and factory test hours. Two engines have completed 2000-hour ground tests—one of these is now flying in G.E.'s leased B-66, approaching 3000 hours total time. Pilots flying CJ-805 powered aircraft will have an engine whose design and operating maturity have been fully proven.

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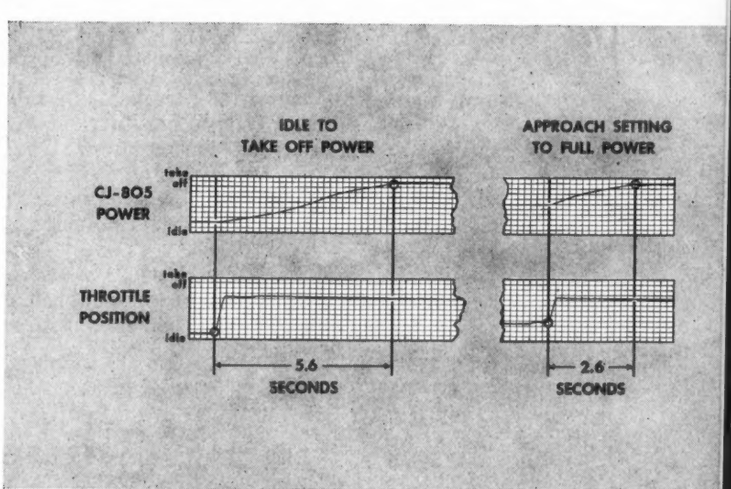
CONVAIR FLIGHT TEST PILOTS flying 880 evaluations are Don Germeraad (left) and Phil Prophett. Observed Germeraad, ". . . The G-E CJ-805 proved to me that it has power when you need it." From their point of view, the CJ-805 is a pilot's engine.



FAST RESPONSE TO THROTTLE takes CJ-805 fan engine from idle to take-off power in 5.6 seconds and from approach settings (20% power) to full power in 2.6 seconds. Brush tracings of an actual CJ-805 run document immediate, dependable response.

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The Paris Equipment Fair

This year's International Air Show at Le Bourget brought further proof that the equipment and accessories industry has maintained its key position in modern aircraft, engine and missile manufacture; indeed it can be said to have strengthened this position compared with earlier years. The number of exhibitors from this branch of the aeronautical industry ran into several hundreds. An attempt has been made in the following pages to give the reader some idea, by means of pictures and telegraphic notes, of the wealth of items shown in this sector alone. Here, of course, chief attention has been paid to major new designs, and exhibits have been classified into general equipment and accessories on the one hand, and products from the electronics industry on the other.

From the Exhibitors' Catalogue

Société ABG, Paris: Spark plugs and ignition systems; igniters for jet engines. Fire detectors under licence from Thomas A. Edison Industries; compressor units for airports.

Ateliers de Constructions Electriques de Charleroi (ACEC), Charleroi: Magnetic tape recorders types 7489 GT/7490 GT and the 7488 M unit for Navy use with two tape speeds (4.75 cm/sec and 9.5 cm/sec); teleprinter systems; transmitter and receiver stations (type AN/CRD 6).

Applications du Roulement (ADR), Paris: Ball and roller bearings to U.S., British and German standards.

Constructions Aéronautiques Aérazur, Paris: Personnel and cargo parachutes for loads of from 50 kg to 10 tonnes; life-jackets, life-boats and life-rafts for 6, 10 or 20 persons; anti-G suits, anti-G valves and auxiliary vehicles for aviation purposes.

Alkan & Cie, Paris: Aircraft armament; racks for bombs, torpedoes, auxiliary fuel tanks; navigation equipment.

Andyar, Neuilly-sur-Seine: Aircraft batteries, including an emergency battery delivering 100 amps for 30 minutes. The production programme still includes the internationally known silver-zinc lightweight accumulators, which can also be used for starting high-power jet engines.

Société Auxilec, Colombes: Transformer groups for use in aircraft and missiles; aircraft synchronous generators for 20 KVA with variable frequency in the 380 to 540 c/s range (Breguet Alizé); 400 c/s asynchronous motors.

Etablissements Aviac, Courbevoie: Electrical and mechancial remote control systems.

Bendix International, New York: Fuel injection and metering systems; jet engine instruments; fuel flowmeters; starters; magneto test sets; dynamos and electrical connectors. Other non-electrical items shown included shock absorbers; hydraulic jacks; wheels; "Cerametalix" brake linings; brake valves and rotor type brakes.

Société Générale des Etablissements Bergougnan, Paris: Aircraft tyres.

Bombrini Parodi-Delfino, Rome: A wide range of ammunition for infantry weapons and artillery, 50-mm rockets, etc.

Brion, Leroux & Cie, Paris: Aircraft instruments: electrical measuring instruments and engine instruments: equipment for flight simulators and flight testing.

Cégédur, Paris: Semi-finished products of high-resistance light metal alloys; sheets and profiles of variable thickness; special alloys.

CIBA (A.R.L.) Ltd., Duxford, Cambridge: Examples of the "Redux" metal bonding process, and samples of "Aeroweb" metal honeycomb material; items showing the use of Araldite epoxy resins (production of high-quality insulations; patterns, models, jigs and tools).

CIMA, Cie Industrielle de Matériel Aéronautique, Courbevoie: Flexible hose; flexible fuel tanks.

Le Collier Industriel, Bry-s/Marne: Stainless steel harnesses.

Dispositifs Oléo-Pneumatiques DOP, Boulogne: Undercarriages and undercarriage parts; wheel brakes; hydraulics.

Division Marston, Fermeture Eclair, Rouen: "Flexelite" flexible fuel tanks and "Marlite" ultralight tanks; synthetic rubber components; examples of fibreglass-reinforced plastics (radomes, antenna casings).

Dowty Group Ltd., Cheltenham: Undercarriages (English Electric *Lightning*, Armstrong Whitworth *Argosy*, Fokker *Friendship*); components of hydraulic systems for aircraft and missiles; fuel feed systems.

S.A. des Pneumatiques Dunlop, Paris: Tyres, wheel brakes and brake pressure regulators; anti-icing equipment; "Maxaret" anti-skid system.

Etudes et Fabrications Aéronautiques EFA, Clichy: Personnel and cargo parachutes: EFA 346 "jacket type" parachute, which can also be equipped with the company's chrono-barometric release system. The parachute has an area of 590 sq. ft., a guaranteed rate of descent of less than 20 f. p. s. and can be used within an aircraft speed range of 0 to 300 m. p. h. The EFA 346 has recently been demonstrated in Holland and the Scandinavian countries, where it has aroused considerable interest.

The English Electric Co. Ltd., London: Gyros and accelerometers for use in control, stabilization and inertial navigation systems.

Equipements Spéciaux pour l'Aviation — ESPA, Montreuil: Flexible hose for high and low pressure; hose junction pieces and special rubber components with high resistance to fuel and lubricants.

Etablissements Faure-Herman, Boulogne: The well-known range of fuel flowmeters, now in quantity production; electrical r. p. m. counters, and fuel contents gauges.

Filotex, Draveil: Electrical cables for radio and radar systems; heat-resistant cables (Types 1900, 2000, 3000 etc., with guaranteed operating reliability up to temperatures of 250°C), also coaxial cables to French and American standards; protective casings and copper braids; multiple cables, insulated wires for microphones, cameras and telephones.

Fokker, Amsterdam: Eckold universal sheet-shaping machines, in particular a model for shaping difficult profiles; Fokker Bond Tester, a machine for testing the quality of metal bonds; electronically-controlled pneumatic joggling machine.

Garrett Corp., Phoenix, Arizona: Turbo-compressors and gas turbines by the AiResearch Manufacturing Division, as discussed in detail in *Interavia* No. 5, 1959.

Giravions Dorand, Paris: EXO simulator DX.43 for training operators for the Nord SS.10 and SS.11 anti-tank missiles.

Etablissements A. Guiot S.A., Paris: Electric pumps; oil filters, fuel filters; water separators and DZUS fastenings.

Etablissements H. B., Issy-les-Moulineaux: Flexible hose and "Rigidinox" metal pipes for use in gas turbines; hydraulic leads for extremely high pressures and temperatures; also hose fittings and "INOX" hose joints.

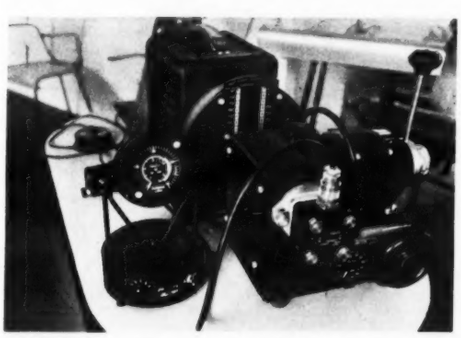
Hobson Ltd., Wolverhampton: Fuel metering systems for gas turbines; servo controls; fuel pumps and other hydraulic equipment; carburetters.

Intertechnique, Boulogne: Current converters; fuel pumps and fuel contents gauges; oxygen regulators; RW-300 digital computer (built under Thompson-Ramo-Wooldridge licence), used primarily for the programming and control of tests and applicable to missile tests, test bench operation, wind tunnel experiments and for the evaluation of telemetered data. Intertechnique also produces airborne computers and sensors for measuring radio-activity.

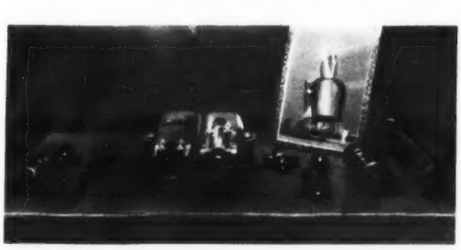
Etablissements Paul Jacottet S.A., Versailles: Remote control systems; electrical servo systems and complete power-boosted controls with hydraulic "feel" simulators; non-reversing Jacottet-Leduc power boosters.

Jaeger Aviation, Levallois-Perret: Aircraft instruments including accelerometers, highly sensitive altimeters for readings up to 80,000 ft., combined airspeed indicators and Machmeters, r. p. m. counters. Other items shown included mechanical and electronic regulation and control equipment.

Air-Equipement, Asnières: Selected items from the exceptionally versatile production programme of this company—a member of the Ducellier, Bendix, Air-Equipement, D. B. A. Group—included electrical starters, aircraft instruments, radio equipment, d. c. and a. c. generators; RDF equipments; TACAN equipment. Air-Equipement is also building a compressed air winch for loads up to 440 lb. for use in the Sud-Aviation *Alouette II* turbine-powered helicopter. Hoisting speed for 220 lb. load is 2 f. p. s.; max. hoisting level 82 ft.



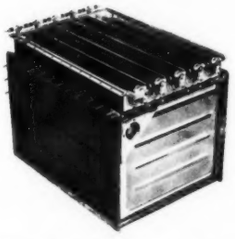
Etablissements A.M.A., Levallois-Perret, showed the precision r. p. m. counter pictured here, and a portable stroboscopic test equipment used by the French Air Force for measuring the accuracy of instrument readings. The A.M.A. r. p. m. counters retain their high accuracy within a relatively wide temperature range (−40°C to +90°C) and are immune to thermal shock. A.M.A. also produces other engine controls and gauges, as well as fire warning systems, air and lubricant filters and oil coolers.



Le Bozec & Gautier, Courbevoie, demonstrated a range of circuit switches, valves for fuel systems (e. g., used in the Nord-Aviation C. 450 Coleopter), electrically operated cocks and fuel and lubricant filters.

Société des Usines Chausson, Asnières, showed light-metal oil coolers (Nord 2501, Breguet 763 and 765, etc.), as well as water radiators, heat exchangers, temperature regulators, vaporizers for use in the air-conditioning systems of the latest jet aircraft (vaporizer for the *Mirage III* in left foreground of picture).

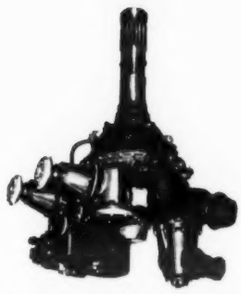
Bronzavia S.A., Courbevoie, exhibited new electrical fuel pumps for a. c. operation and for delivery rates of up to 20,000 litres per hour (Type 3450 for two speeds and deliveries of up to 10,000 litres/hour in centre of picture). The Company also produces 750 VA and 20 KVA converters and 2 KVA and 6 KVA rectifiers with silicon diodes. Also cartridge starter turbines; turbo-generators and turbo-pumps; servo systems; data transmitters; VHF and UHF radio equipment and general airframe accessories (e. g. Napier "Spraymat" de-icing system).



Delanay Gallay Ltd., London: A wide variety of heat exchangers of light alloy or stainless steel. Picture shows a stainless steel exchanger used in the Vickers *Vanguard's* anti-icing system. The company supplies similar equipment for the Fokker *Friendship,* Bristol *Britannia,* Armstrong Whitworth *Argosy,* Vickers *Viscount* and Handley Page *Herald.* Other exhibits included fuel-cooled high-pressure oil coolers.

Paris 1959

Hispano Suiza, Bois-Colombes, displayed undercarriages as used in the Breguet *Alizé,* Sud-Aviation *Caravelle,* SE.3200 etc.; also ejection seats under Martin-Baker licence; pumps for hydraulic systems; the HS.48 mobile air compressor (picture) for starting gas turbines and checking aircraft compressed air systems on the ground (with 240 h. p. diesel; delivers 0.8 kg of compressed air per second with a compression ratio of 4 : 1; certificated for 3,000 operating hours between overhauls). Also on show was the reduction gear (picture) for the Sud-Aviation SE.3200 *Frelon* helicopter; this gear can handle a total power of up to 2,100 h. p. and weighs 995 lb. without accessories.



From the Exhibitors' Catalogue

Kléber-Colombes, Paris: High and low pressure aircraft tyres (for *Caravelle, Noratlas, Mirage III* and *IV, Etendard IV M, Alizé,* etc.); tubeless tyres. On show for the first time were special tyres for high-speed aircraft (e.g. *Mirage III*) with laminated tread (several nylon layers inserted into the rubber) to eliminate shock waves. Also tyres with sinewave profile. Further exhibits on the stand were examples of pneumatic de-icers for wing and tailplane leading edges and propellers, also "Altitherm" electrically heated anti-icing protection (for propellers, antenna masts, air intakes of turbine engines, etc.). Finally, the well-known "Altitube" pneumatic cabin sealing system for high-altitude flight, and examples of the use of "Klégécell" and "Klémocell" cellulose structural materials.

Précision Mécanique Labinal, St. Ouen: D.C. and A.C. generators for powers up to 12 kW; starters; regulators; switches, etc., including Type 4560 thermal switches (average weight 50 g) for very high voltages and push button operation.

Le Matériel Téléphonique LMT, Boulogne-Billancourt: Transistorized automatic seat reservation system designed to permit numerical and alphabetical recording of reservations, cope with cancellations and changes of reservations and supply the required passenger lists immediately before the aircraft's departure.

Lodge Plugs Ltd., Rugby: Spark plugs and test equipment for plugs.

Microtecnica, Turin: Synchronous generators for 50, 60, 400 and 1,000 c/s; artificial horizons (Bendix J8-F1 licence); pressurization and air conditioning systems for the G.91 (AiResearch licence), also navigation instruments, autopilots, gyro compasses, etc.

Société d'Optique, de Mécanique, d'Electricité et de Radio (OMERA), Argenteuil: Electronic, optical and precision mechanical equipment; VHF and UHF equipment; model of a weather radar station (Decca licence) and a light airport surveillance radar (Decca 424 licence); AP.30 and AP.31 aircraft cameras and EV.20/EV.110 camera guns. The company also manufactures aircraft transmitter/receivers under SARAM licence (VHF: SARAM TRAP. 6; UHF; SARAM TRAP.11A and 21A).

N. V. Philips Gloeilampenfabrieken, Eindhoven: Multi-channel magnetic tape recorders for airports and industrial plants, including the 15-channel EL 3590/0.0 for 16-mm tape and the associated EL 3591/0.0 playback equipment. Also various examples of approach lights and runway and taxiway lamps: Type PS-24 high-intensity adjustable approach light; Type PS-25 countersunk, high-intensity runway light.

Précilec S.A., Paris: Small electric motors, particularly for servo controls.

Radio-Air, Asnières: Transmitter/receivers types ERT 282 (100 watts) and ERM 281 (100 watts); ENB 283 airborne magnetic tape recorders; radio compasses.

Ratier-Figeac, Paris: Variable pitch propellers for the *Bastan* and *Astazou* turboprops; components for fixed-wing aircraft, helicopters and missiles.

Rellumix, La Garenne-Colombes: Equipment for aircraft fuelling, fuel filters, water separators, filling manifolds, metering equipment, "Prematic" pressure regulators and "Fipoca" indestructible filter elements.

Rubanox, Neuilly: Exhaust gas manifolds for piston engines and jet pipes for gas turbines, including the Turboméca *Marboré II* jet and the *Dart* turboprop as used in the Breguet *Alizé* anti-submarine aircraft.

Saint-Chamond Granat, Courbevoie: Measuring equipment for flight testing and ground trials, and 400 c/s electrical equipment for air and ground use; accessories for the parachute dropping of heavy loads.

Société des Accumulateurs Fixes et de Traction — SAFT, Romainville: "Voltabloc" no-maintenance aircraft batteries; starter sets.

Société d'Applications Radioélectriques à l'Aéronautique et la Marine — SARAM, Asnières: VHF and UHF transmitter/receivers for aircraft and ground use (VHF: Types 5-41, 5-42 and 5-52; UHF: Types TR-AP-11A, TR-AP-21A and 7-60 Marine).

Société de Recherches de Mécanique Appliquée — SARMA, Saint-Vallier-sur-Rhône: Aircraft controls; automatic tension device for cables and belts for ejection seats.

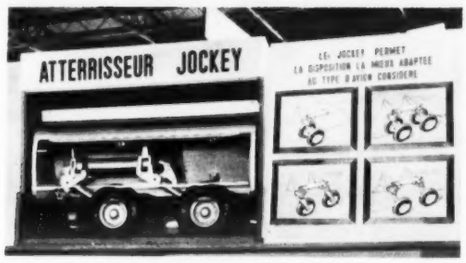
Sciaky S.A., Paris: P.200 STK three-phase spot welding machine and other welding equipment.

Société d'Etudes et de Constructions Aéro-Navales — SECAN, Gennevilliers: Jettisonable auxiliary fuel tanks for suspension beneath the wings or fuselage or at the wing tips: Type 63 of 450 litres capacity for the *Ouragan, Mystère II* and *IV;* also Type 51 for roughly 100 litres capacity.

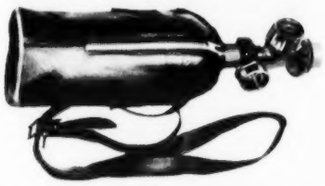
Well-Known Personalities at the 23rd Air Show

1 2 3 4

1 — General Charles de Gaulle, President of the Republic, visits the Salon (June 13th, 1959; 08: 15 hrs). 2 — Defence Minister Pierre Guillaumat (right) and Henri Desbruères, President of SNECMA and of the 23rd Paris Show, during the opening tour. 3 — Marshal of the Royal Air Force Sir Dermot A. Boyle, Chief of the Air Staff. 4 — Defence Minister P. Guillaumat talking to Jean Volpert, Technical Director of SEPR.



Société Messier, Montrouge, showed undercarriages for modern combat aircraft, such as the *Mirage III* and *IV*, Nord *Griffon* and Fiat G.91, also hydraulic and electro-hydraulic actuators; hydraulic pumps. On show for the first time was a model of the new "Jockey" all-terrain undercarriage, designed in particular for modern freighters and assault transports. As the picture reveals, the undercarriage can be of various designs: single-leg dual-wheel; tandem arrangement with single or dual tyres, etc. Messier also exhibited examples of the test stands still in production and products from its electronics department.

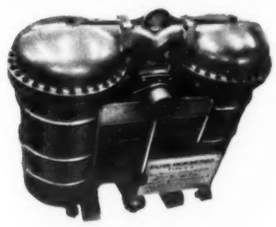


Normalair Ltd., Yeovil: Oxygen supply equipment (picture shows a portable lightweight oxygen set); also pressurization and ventilation systems; equipment for the regulation of cabin air temperatures; mobile test stands for checking the functioning of pressurization and air-conditioning systems.

Vibrachoc, Paris, showed examples of the all-metal shock and vibration dampers manufactured in large numbers under Robinson Aviation licence, and the Plasteck lighting system for aircraft instruments and equipment panels under U. S. licence.

Société d'Applications des Machines Motrices — SAMM, Boulogne-Billancourt: Electro-hydraulic servo controls (picture); control columns; micro switches and armaments accessories (e. g. fixed and mobile supports for aircraft cannon and machine guns); rotating gun turrets with hydraulic operation and remote control.

W. Vinten Ltd., London: This high-speed take-off monitoring camera (360, 540 or 720 frames per minute) was specially designed for the observation of take-off and landing manoeuvres in extremely high-speed aircraft. Focal length 50 cm; f = 1 : 5.6; cassettes with 120 m of film for 1,280 frames; exposures from 1/60 to 1/240 second; recorder for 10,000ths of a second.



Sofrance S.A., Limoges: Gasoline and kerosene filters, including the K3-50/60, weight 160 kg, for a flow of up to 60 m³ of fuel per hour. Life of individual filter elements two to four years.

From the Exhibitors' Catalogue

Société SEMCA, Toulouse-Aucamville: AT 1010 compressed air starter for gas turbines (SNECMA Atar); effective torque moment 60 mkg up to a rev. speed of 2,500 r. p. m.; weight 9 kg. Also air-conditioning systems; Type 2042 cabin pressure regulator; valves and turbine cooling equipment.

Société Française d'Equipements pour la Navigation Aérienne — SFENA, Neuilly: Gyros and magnetic compasses; gyro horizons Type EG 6071 AF (for *Caravelle)* and models 703 (for *Mirage III)*, 5035 and 5135. Complete navigation equipment; autopilots and control systems for missiles; yaw dampers; special motors; servo motors; magnetic amplifiers.

Société Française d'Entretien et de Réparation de Matériel Aéronautique — SFERMA, Bordeaux-Mérignac: EC.801 process for sealing fuel tanks.

Société de Fabrication d'Instruments de Mesure — SFIM, Massy: Aircraft instruments (NRAN 8 and 9 radio compass; fitted e. g. in *Super Mystère);* SFIM-ONERA airborne telemetering equipment; oxygen regulators; stall warning indicators.

Société Française d'Optique et de Mécanique — SFOM, Rueil: Aircraft cameras; sights; photogrammetric equipment.

Société Générale d'Equipements — SGE, Puteaux: Aircraft electrical equipment (e. g. under Lear licence); thermal switches for currents between 5 and 50 amps; lightweight multiple connectors; aircraft lighting systems; electrical servo motors; aircraft and ground test equipment.

Simmonds S.A., Suresnes: "Simloc" and "Nylstop" safety nuts.

Société Socapex, Suresnes: Miniature electrical connectors (Series 62 with 5 to 24 contacts; operationally reliable within a temperature range of −55 °C to +100 °C); also Series T connectors (Radio-Air) with up to 43 contacts; tropical connectors; microphones and headphones.

Souriau & Cie., Billancourt: Multiple connectors in normal, miniaturized and sub-miniaturized sizes, to French, British and American standards; also connectors for aircraft and missiles; intermediate connectors; ignition connectors for rockets; printed circuits; equipment racks; headphones; connectors with fibreglass insulation and normal and sub-miniaturized coaxial cables.

Superflexit S.A., Courbevoie: Flexible fuel tanks and flexible hose.

"Textiglass", Pierre Genin & Cie. S.A., Paris/Lyons: Fibreglass fabrics for electrical equipment, plastics articles, anti-corrosion use, industrial fabrics of nylon, Tergal, Crylor, Meryl.

Técalémit S.A., Paris: Técalémit-Aeroquip high-pressure pipes; filters for fuels and water-methanol mixtures.

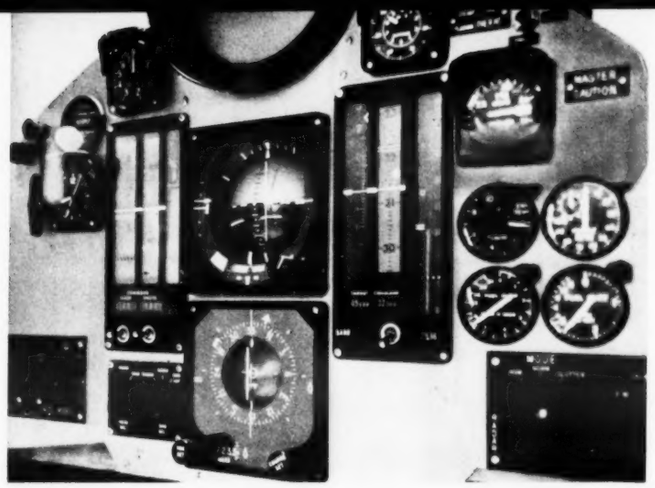
Glace Triplex, Longjumeau: Safety glass and armour-plated glass (e. g. windshield for Breguet *Alizé);* Triplex "Therglas" treated against misting and frosting.

Turboméca, Bordes: *Béarn* airport air compressor for maintenance purposes and engine starting, equipped with a *Palouste IV* gas turbine and capable of operating for roughly one hour without refuelling.

Société du Carburateur Zenith, Levallois-Perret: Equipment for fuel filling, circuit and feed; carburetters; filters; pumps; Bendix, Hobson, Flight Refuelling, Plessey and Saunders Valve licences.

5 6 7 8 9

5 — Defence Minister P. Guillaumat and Henri Ziegler (Managing Director, Breguet). **6** — Georges Héreil, President and Managing Director, Sud-Aviation. **7** — Lieutenant General J. Kammhuber, Inspector of the Federal German Air Force, with A. Rothe (Manager, Focke-Wulf; left) and Professor H. Hertel (Berlin Institute of Technology). **8** — Jean-Noel Adenot, Secretary General of Union Syndicale des Industries Aéronautiques. **9** General J. Accart (with pipe), well-known fighter pilot and Deputy to the Air Force Adjutant General, with General Maurice Challe, Commander-in-Chief in Algeria.

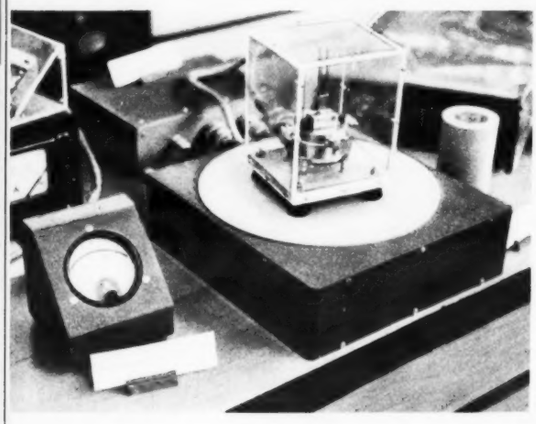


Paris 1959

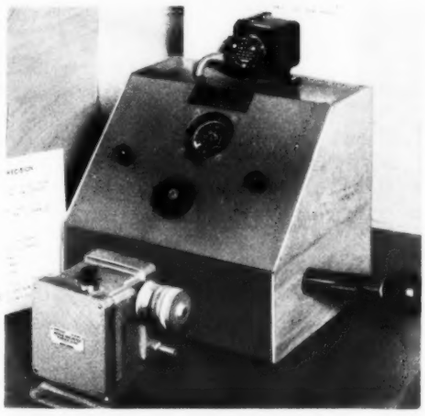
Aircraft Instruments an

AMERICAN FUTURE

An American exhibit in the Space Age Exhibition at Le Bourget. It illustrates a proposed instrument panel layout to simplify the presentation of information to the pilot. Below the radar display are the flight and navigation indicators flanked by the vertical reading Airspeed Indicator/Machmeter, Altimeter and Rate of Climb indicator.



Bronzavia *(Paris)* exhibited a new rate of turn indicator which is undergoing development in their Electronics Division. Basic component is a tuning fork maintained in vibration electrically. Rotation of the fork about its axis displaces its vibratory plane, and the angular displacement can be measured in both direction and amount through a transistorized amplifier which completes the unit.



Altitude warning device and precision barometer designed and manufactured by **Mechanisms Ltd.** *(Croydon, Great Britain)*. The Altitude Warning consists of a cockpit mounted amber lamp which commences flashing when the aircraft passes through a predetermined altitude. The barometer is designed to satisfy the requirement for a lightweight, portable precision instrument in place of the standard mercury barometer.

A wide range of radio, telecommunication and navigation equipment was exhibited on the **Murphy Radio Ltd.** *(Welwyn, Great Britain)* stand. Also featured was the Leader Cable Automatic Landing System and the MK 380 Aircraft Tape Reproducer.

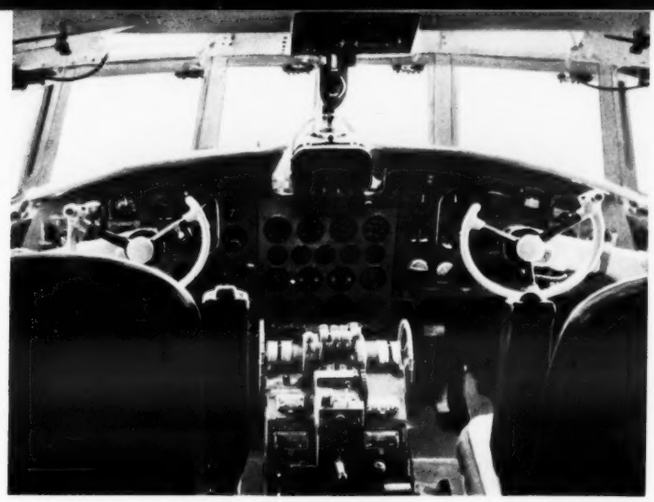
The main feature of the **Cossor Radio** *(London, Great Britain)* stand was the display of radar transponders for military and civil use. The military version in a pressurized drum is on the left, the civil version is made in a rectangular format.

10 11 12 13 14

10 — Joseph Szydlowski, President and Managing Director of Turboméca. **11** — Paul Moroni, Secretary General for Civil Aviation (left) with Felix Frémont (General Electric, Paris) and R. E. Small (General Electric, Geneva). — **12** General Andrei N. Tupolev. **13** — Pan-German discussion in Paris; left to right: Dipl. Ing. W. Künzel (General Manager, Technocommerz GmbH, Berlin), Dipl. Ing. K. Schwärzler (Ernst Heinkel Flugzeugbau GmbH, Speyer), Professor B. Baade (Technical Director, Association of People's Aircraft Manufacturing Plants, Dresden). **14** — Sir Arnold Hall, Managing Director, Bristol Siddeley Engines Ltd. and Technical Director, Hawker Siddeley Group.

15 — An Italian A London

nts and Electronic Equipment

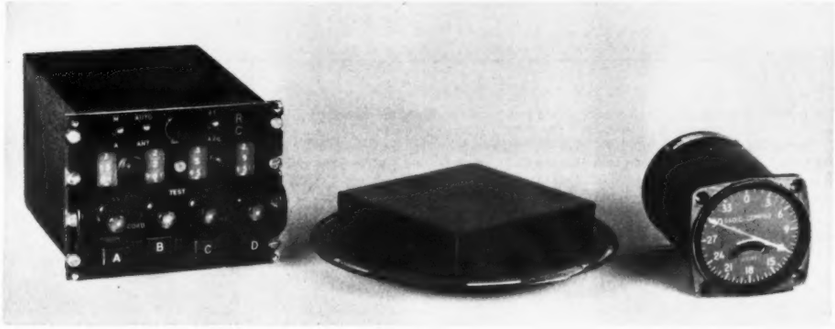


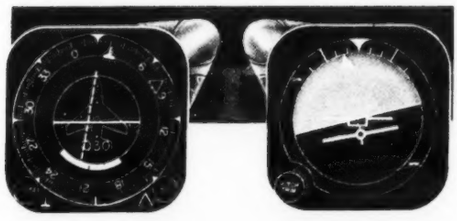
RUSSIAN PRESENT

The cockpit of the IL-18 *Moskva* which took part in the flying display. First impressions are of simplicity and symmetry of layout, and similarity to Western design practice.

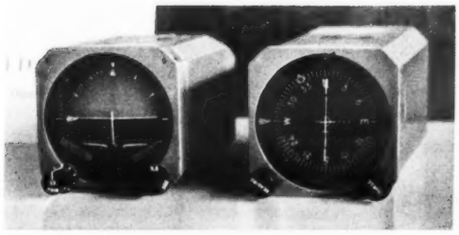
Internal view of the **Minneapolis-Honeywell** *(Minn USA)* gyro stabilized platform, manufactured in France under licence by the **Société Alsacienne de Constructions Mécanique** *(SACM)* and designed for inertial guidance applications.

Control unit, aerial and indicator of the RC 232 transistorized radio compass designed and manufactured by **Compagnie Générale de TSF** *(Paris)*. On the control box can be seen the four tunable channels with press button changeover switches.





Course deviation indicator and horizon director indicator of the *Bendix Flight Director System*, manufactured by the Eclipse-Pioneer Division of **Bendix Aviation Corporation.** *Teterboro. N.J. U.S.A.*



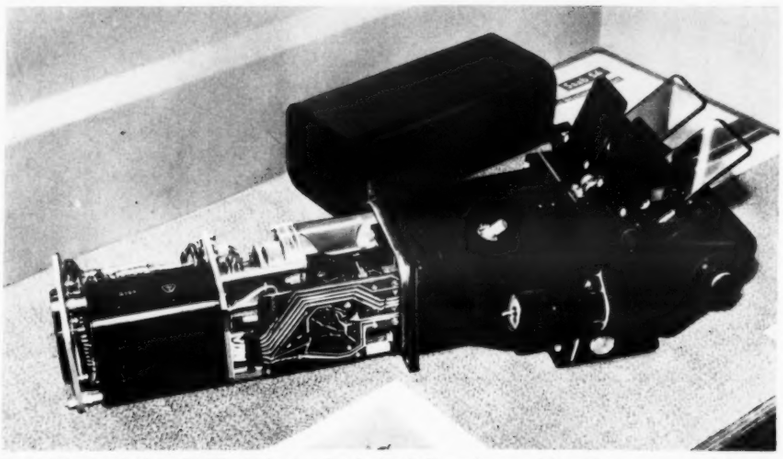
The 4 inch instruments for the **Collins Radio Company** *(Cedar Rapids, Iowa, USA)* flight director FD 105 *(Integrated Flight System)*. Basic attitude information, navigation situation and flight director steering are presented on the two instruments. The two colour horizon background further simulates the pilot's forward view of the flight.

Among the instruments and navigation equipment exhibited by **Lear Inc.** *(Santa Monica, Calif.)* was the simulator for the *Lear Integrated Flight Equipment (Life)*. Visitors to the stand were able to carry out a simulated instrument approach on this transportable equipment and on completion received a printed record of their skill.

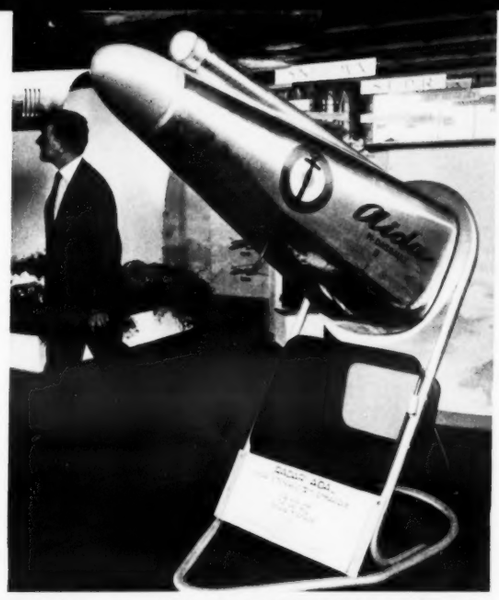
15 **16** **17** **18** **19**

15 — André Granet, Commissioner General for the Paris Air Show since 1909, was celebrating his Golden Jubilee in office. **16** — Engineer General Alfredo Bruno, President of the Italian Aircraft Manufacturers Association. **17** — Dr. Baeumker, U.S. Air Force. **18** — Dr. G. V. Lachmann, Director Scientific Research, Handley Page, with Derek Wood, Interavia's London Editor. **19** — Major Hubert Cournal, aide-de-camp to General M. Vallin (centre) and M. François-Poncet Jr. (right).

Paris 1959

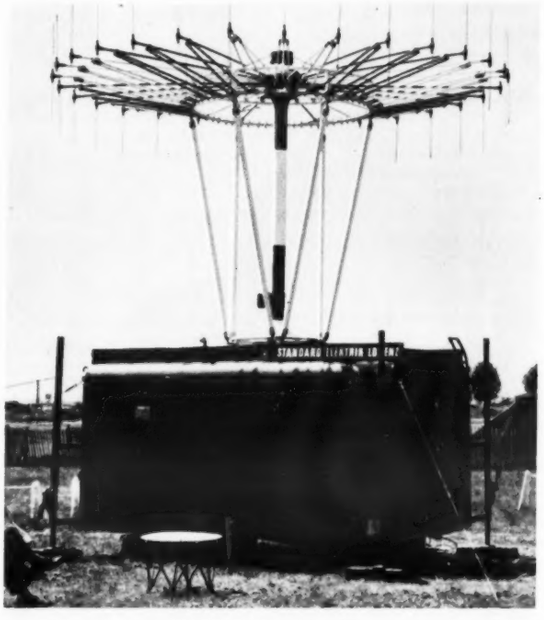


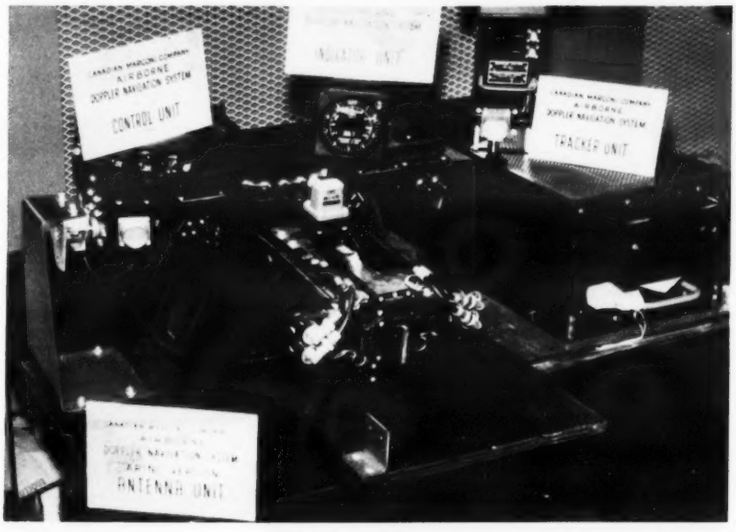
The sighting head of the **SAAB** *(Linköping, Sweden)* S. 6 all-weather gunsight with cover removed. It contains the sight line stabilizing rate gyro and the cathode ray tube which transmits the radar information to the pilot.



The *Aida* fire control radar developed by **GAM Dassault** *(Paris)* for the naval *Etendard IV M*. For use with cannons, rockets, bombs and missiles, it forms a self contained electronic package which is fitted on the nose of the aircraft and can be exchanged or removed for servicing as required.

The mobile ground installation and aerial array for the **Standard Elektrik Lorenz AG** *(Stuttgart, W. Germany)* Doppler Direction Finder VDF 1. Operating in the VHF band 100–156 Mc/s, the equipment can plot the bearings of two transmissions simultaneously on different frequencies. Bearing information can be presented on either a cathode ray tube or pointer display.





Units of the CMA. 620 Doppler Navigation Sensor built by the **Canadian Marconi Company** *(Montreal, Canada)*. Employing an FM/CW technique developed by the company it has undergone successful evaluation trials by a number of airlines and is already installed in Pan American's Boeing 707's. Weighing less than 70 lb. performance trials indicate an accuracy to ¼° in drift and 0.8% in groundspeed over land and sea surfaces. Over extremely still water the equipment is capable of automatic transition to a smooth sea mode to maintain accuracy. System performance is continuously checked automatically by a "lock check mode" which ensures that the tracker is locked on to the Doppler spectrum.

20 **21** **22** **23** **24**

20 — Mike F. Oliveau, Vice President — European Division, Douglas Aircraft Company. **21** — Dr. Ing. Paolo Foresio, President of Aeronautica Macchi. **22** — Mrs. Peg G. Coale, Public Relations Manager, Vertol Aircraft Corporation. **23** — Dr. von Wattendorf, AGARD. **24** — Aeroflot pilots in their new summer uniform.

LE FIGARO

AUJOURD'HUI ET DEMAIN AU BOURGET

GRANDE PARADE FINALE DU SALON DE L'AVIATION

Si le temps magnifique qui a favorisé ce Salon aéronautique du Cinquantenaire veut bien persister deux jours encore, les fêtes aériennes d'aujourd'hui et de demain promettent d'être tout simplement apicendides. C'est que, de stratégie qu'elle était depuis huit jours, la grandiose confrontation internationale du Bourget va devenir extrêmement dynamique. Et même, à l'occasion, hypersonique.

Et puis, on verra voler les maîtres du transport lourd, aux évolutions majestueuses, l'élégante et fine Caravelle, les bolides hargneux de la chasse, les bombardiers supersoniques, les prestes avions d'entraînement qui ont l'air de parler avec leurs mains, les hélicoptères aux voilures jacassantes, toute une gamme de couleurs, de vitesses et de bruits.

Tel aussi le concours de la grande revue internationale Interavia, dont les gagnants ont été connus, chez Drouant, au cours d'un déjeuner où l'on retrouvait, autour du docteur Heyman, MM. Max Hymans (Air France), Périer (Sabena), Gross (Lockheed), Gabrielli (Fiat), Delgado (Iberia), le général Kammhuber (Luftwaffe), membres du jury, et de nombreux invités de marque.

Deux cent trente-cinq auteurs de vingt-huit pays différents ont concouru sur l'un des deux sujets, l'un concernant le développement de l'aviation commerciale, l'autre sur l'alternative avion piloté ou engin. En dépouillant les enveloppes des six gagnants, M. Max Hymans a eu la vive surprise de retrouver, sous le pseudonyme de Philéas Fogg, une collaboratrice et ami Raymond Nivet, inspecteur principal à Air France, qui gagne ainsi le deuxième prix de 1.500 dollars. Le vainqueur « commercial » est un Australien, « Britannicus », autrement dit M. Sturgeon. Le troisième prix revient à M. Crastree, de Londres.

Côté militaire (aussi), M. Doerfel, de Zurich, remporte le premier prix de 1.500 dollars, suivi de M. Delmastro, de Turin, et de M. Haggerty, de Washington.

Pierre Voisin

Arrivée au Bourget du « TU-114 » soviétique

Le « TU-114 », qui a atterri au Bourget pour la première fois hier après-midi, a relié Moscou à Paris en 4 heures un quart de vol environ.

Très haut sur son train d'atterrissage, un cranbeau de 5 mètres de haut lui est nécessaire pour débarquer ses passagers, mais comme l'aéroport n'en possède pas d'aussi grand, il a fallu faire appel à une échelle supplémentaire.

Le Monde

LES PRIX «INTERAVIA»

La revue internationale d'aéronautique Interavia, publiée en Suisse, dirigée par le Dr E. Heiman, a décerné hier les prix d'un concours qu'elle a organisé entre ses lecteurs. Il s'agissait de répondre aux questions suivantes, les réponses devant être publiées par la revue :

1) POUR L'AVIATION COMMERCIALE. — « Comment le transport aérien européen peut-il utiliser de plus en plus de voyageurs sans pour autant compromettre l'économie de son exploitation ? »

2) POUR L'AVIATION MILITAIRE. — « L'avion-pilote a-t-il fini de jouer son rôle ? Doit-il déjà démissionner devant l'engin ? Ou bien les deux armes continueront-elles longtemps encore à être utilisées simultanément ? »

C'est un Australien, M. R.W. Sturgeon, de Bristish, qui, pour l'aviation civile, a remporté le prix de 1 500 dollars, 1 000 dollars allant à M. Raymond Nivet, inspecteur principal d'Air France, et 250 dollars à M. Hedley Crabtree, de Londres.

Pour la question portant sur l'aviation militaire, M. Ulrich Doerfel, de Zurich, a remporté le premier prix de 1 500 dollars, suivi de MM. F. Delmastro, de Turin, et de J. Haggerty, de Washington, gagnant respectivement eux aussi 1 000, 750 dollars.

Le jury était constitué par M. Max Hymans, président général d'Air France ; M. Gilbert Périer, président de la Sabena ; le général I.A. Aler, président de la KLM ; M. Keith Granville, deputy managing director de la BOAC ; l'air-commodore W. Den Toom, de l'ambassade des Pays-Bas ; M. Thomas Delgado, président de l'Iberia ; M. Bernhard, président de la Swissair ; M. Robert E. Gross ; le général Kammhuber, inspecteur de la Luftwaffe, et enfin, professeur Giuseppe Gabrielli, directeur général de Fiat Aviazione.

« Partie de plaisir » bien feudi dans le ciel de France ! La compagnie aérienne européenne Aeroflot étant autorisée à survoler le territoire de la France, le professeur Giuseppe Gabrielli, directeur général de Fiat Aviazione, a fait un vol à bord du Tupolev 104 B. Cet appareil, qui est en service sur de nombreuses lignes du réseau intérieur russe et assure quelques liaisons internationales, est propulsé par deux réacteurs de grande puissance. Il peut emmener cent passagers à une vitesse de croisière de 900 kilomètres à l'heure et à une altitude maximum de 12 000 mètres.

The panel of adjudicators (left to right): Don Tomás Delgado, President, Iberia; Air Commodore W. den Toom, representing H.R.H. Prince Bernhard of the Netherlands; Keith Granville, Deputy General Manager, BOAC; Robert E. Gross, Chairman, Lockheed Aircraft Corp.; General I. A. Aler, President, KLM; Dr. E. E. Heiman, Managing Director, Interavia; Max Hymans, President, Air France; General Josef Kammhuber, Inspector of the West German Air Force; Professor Giuseppe Gabrielli, Managing Director, Fiat Aviazione; Gilbert Périer, President, Sabena (not visible in picture).

In the Steps of the Brothers Goncourt

Picture Report on the Interavia Essay Competition

President Robert E. Gross opens the envelope of one of the military prize-winners.

President Max Hymans does likewise for a civil prizewinner.

Sabena President Gilbert Périer talking to Air Marshal Sir Colin Weedon, of Rolls-Royce.

NEW YORK Herald Tribune

Aviation Essay Contest Winners Are Announced

The international prize-winners of the $3,000 contest of the European aviation magazine "Interavia" for the best articles on the future of commercial and military aviation were announced yesterday at a luncheon given by E. E. Heiman, founder of the publication, at the Restaurant Drouant, in Paris, and attended by numerous representatives of international aviation and the press.

To the question "How can the airlines make air travel accessible to the broadest sections of the population without endangering their economic stability?" the answer winning the first prize of $1,500 went to R. W. Sturgeon, of Australia, while the second prize of $1,000 was won by Raymond Nivet, of France.

To the question: "Is the piloted aircraft played out, must it abdicate in favor of the guided missile, or will the two weapons continue to exist side by side for a long time to come?" the prize-winning answer was furnished by Ulrich Dorfel, of Switzerland, with the two Italians, M. F. Delmastro and M. P. Cesmari-Curto sharing the second price of $1,000.

The military consolation prize of $250 went to James C. Haggerty Jr., of the United States, and the civil aviation consolation prize to Herbert Crabtree, of Britain.

A total of 235 replies from 28 countries was received.

Neue Zürcher Zeitung

Luftverkehr

Preisträger des «Interavia»-Wettbewerbs

Paris, 18. Juni. ag (AFP) Eine Jury von zehn der besten Kenner des Flugwesens trat in Paris zusammen, um die Ergebnisse eines Wettbewerbs zu beurteilen, den die in Genf erscheinende Zeitschrift «Interavia» veranstaltet hat. Den Wettbewerbsteilnehmern waren zwei Fragen vorgelegt worden: 1. *Zivilluftfahrt:* Wie kann der entsprechende Luftverkehr mehr und mehr Reisende anziehen, ohne dadurch seine Wirtschaftlichkeit zu beeinträchtigen? 2. *Militärluftfahrt:* Hat das bemannte Flugzeug seine Rolle bereits ausgespielt? Muß es der Rakete weichen, oder werden die beiden Waffen noch für lange Zeit gleichzeitig verwendet werden?

Für die Beantwortung der Frage über die Zivilluftfahrt erhielten R. W. Sturgeon (Australien) 1500 Dollar, *Raymond Nivet*, Chefinspektor der Air-France, 1000 Dollar und Hedley Crabtree (London) 250 Dollar. Für die Beantwortung der Frage über die militärische Luftfahrt erhielten *Ulrich Dörfel* (Zürich) 1500 Dollar, *F. Delmastro* (Turin) 1000 Dollar und *James J. Haggerty* (Washington) 750 Dollar.

Das *Preisgericht* setzte sich zusammen aus: Max Hymans, Generaldirektor der Air-France, Gilbert Périer, Präsident der Sabena, I. A. Aler, Präsident der KLM, Commodore W. den Toom von der niederländischen Botschaft, der Prinz Bernhard vertrat, Keith Granville, stellvertretender Direktor der BOAC, Thomas Delgado, Präsident der Iberia, Dr. W. Bernhold, Direktionspräsident der Swissair, Robert E. Gross, Präsident der Lockheed Aircraft Corporation, General Joseph Kammhuber, Inspekteur der westdeutschen Luftwaffe, Prof. Giuseppe Gabrielli, Generaldirektor der Fiat-Aviazione.

LA TRIBUNE DE GENÈVE

Le Concours international d'Interavia s'achève par une surprise

Un Zuricois décroche le premier prix militaire

C'est au second étage d'un célèbre restaurant parisien qu'on réalisa jeudi ce prodige : concentrer sur la plus petite surface possible le plus grand nombre de personnalités œuvrant pour la conquête de l'espace. C'est Baudelaire, chères ailes de géant qui empêchent de marcher... Il était difficile de faire un pas sans écraser les pieds d'un général de l'air ou ceux du représentant d'une titanesque entreprise de construction aéronautique ou de transports aériens. Il y avait là, aux côtés du directeur général de la Flat-Aviazione et de la Lockheed Aircraft Corporation, le professeur Dornier, président de la firme Dornier et M. Henri Potez, président de la Société Potez. Le général Kammehuber, inspecteur de la Luftwaffe n'était pas loin du général d'armée Chassin. Nous citons ces noms presque au hasard dans l'impossibilité où nous sommes de reproduire ici une page entière du « gotha » aérien... ou plus précisément la liste des invités d'« Interavia ».

Mais laissons à M. Heiman, administrateur-délégué de cette brillante revue le soin d'exposer ici, comme il le fit à Paris, le pourquoi de ce rendez-vous international : « Le monde de l'aviation se trouve actuellement à la croisée des chemins : les jets transforment le transport aérien et l'électronique le transport aérien et l'électronique bouleverse la défense aérienne. Pour tenter d'éclaircir cette situation nouvelle et de cristalliser ces idées neuves, « Interavia » a lancé un premier concours doté de 5500 dollars de prix. Et nous avons posé, en juin 1958, les deux questions suivantes :

1. Pour l'aviation commerciale : « Comment le transport aérien international peut-il attirer de plus en plus de voyageurs sans pour autant compromettre l'économie de son exploitation ? »

2. Pour l'aviation militaire : « L'avion piloté a-t-il fini de jouer son rôle ? Doit-il déjà démissionner devant l'engin ? Ou bien les deux armes continueront-elles longtemps encore à être utilisées simultanément ? »

Un jury composé essentiellement de directeurs de compagnies aériennes (dont M. Berchtold, président de la Swissair) eut la lourde tâche de retenir six travaux ou plus exactement d'en écarter 229 autres ! Cette tour de contrôle était en même temps une tour de Babel, les textes provenant de 28 pays différents et étant rédigés en français, en anglais, en allemand et en espagnol. C'était aussi une tour d'ivoire : les grands juges maintinrent autour de cette compétition un silence d'autant plus absolu qu'ils ignoraient — en vertu d'un système de numérotation — le nom et la nationalité des concurrents.

D'où la minute de suspense lorsque M. Max Hymans, qui est fonctions de président du jury appelait en l'occurrence le cerbère de Grand Dénominateur, brandit les six enveloppes qui renfermaient, pour quelques instants encore, l'anonymat des lauréats. Le président d'Air-France n'eut pas à réclamer le silence. Ce fut comme si les hôtesses d'un quadrimoteur s'étaient mises en place en plein vol. Un grande était l'attente que certains verres de whisky prirent une importance dangereuse et que plusieurs par des mains distraites, des olives en sortirent en vrille. Et l'on n'entendit plus que le bruit du papier déchiré... avant que des noms ne fussent lancés dans la foule des journalistes — ce moment fut le plus intense de la journée — et ne commence la proclamation des résultats. (1). Le huitième prix international remporté dans la spécialité du Concours. Et, ironie du sort ou juste récompense, notre page qui connut les déboires que l'on sait en matière de construction aéronautique place un Zuricois au premier rang des lauréats « militaires », écrasé par le monde ne réjouit de ce succès suisse. « petit lunch » qui suivit cette annonce n'était pas de nature à altérer la bonne humeur générale. A déguster le champagne du vainqueur, on fêta également à la Parisienne cet hommage à la valeur de l'aspect durant cette journée. Et en mettant à l'honneur de Champagne dominèrent au nom « qui ne manquait ni de charme ni d'élégance.

P. L.

(1) La liste des lauréats a paru dans notre numéro de vendredi dernier.

"The second floor of a famous Paris restaurant was the scene of a remarkable achievement: the packing into the smallest possible area of the largest possible number of personalities concerned with the conquest of space . . . Hardly could one take a step without treading on the toes of an air force general, a representative of a giant aircraft company or airline . . ."

Very flattering, these remarks of the Paris representative of the Swiss daily with perhaps the largest circulation, but probably slightly exaggerated.

He had, of course, not witnessed what had taken place before. At a round table ten feet across sat the members of the two adjudication panels to select, out of 235 essays submitted, three each on new ideas in civil and military aviation. It was indeed a sacred spot! for this very table is the yearly meeting-place of the judges who award the Prix Goncourt, which can bring international fame to the best French writer of the year and be decisive in his literary career.

Reception: adjudication panel and guests.

Air France President Max Hymans talking to his Managing Director Louis Lesieux.

Alvis Chairman J. J. Parkes (left) and well-known engine expert Air Commodore F. R. Banks.

General Kammhuber (left) and Robert E. Gross.

Left to right: Messier President René Lucien; Professor Dr. Claudius Dornier, founder of Dornier-Werke; Dr. Eduard Ganzoni, representative of the Swiss News Agency.

Hispano-Suiza President Maurice Heurteux (centre) and Potez President Henri Potez.

The adjudicators' table.

General Pierre M. Gallois of Dassault (left) and General J. M. Montgomery of General Electric; in background is Northrop President Thomas V. Jones.

Air Commodore Banks, J. H. Davis (left), Canadair Vice-President Peter H. Redpath, J. J. Parkes, Alvis (right).

Right to left: Ben Marble and M. E. Oliveau, Douglas; Carl Cleveland, Boeing; Thomas V. Jones, Northrop.

Left to right: Ed Fife of Lockheed; David A. Anderton of Aviation Week; *Northrop President Thomas V. Jones; Lear Inc. President Richard M. Mock; General L. M. Chassin; Air Commodore Payne of the* Daily Telegraph.

A French table (left to right): Georges Février, Interavia France; General Pierre M. Gallois; Breguet Managing Director Henri Ziegler; SNECMA President Henri Desbruères, also President of the 23rd International Air Show; Air France Managing Director Louis Lesieux.

Cocktails before lunch: Foreground (left to right): M. E. Oliveau, Ben Marble, Douglas; Ed. Fife, Lockheed and David A. Anderton, European representative of Aviation Week.

Last but not least. A section of the Interavia *"brains trust": Pia Russak, advertising representative, Geneva, centre; Georges Février, Interavia France, left; Derek Wood, Interavia United Kingdom, right.*

Nor had the twelve aviation experts sitting at this famous table any less sense of their responsibility. Their task was, it is true, lightened by one of the competition rules: they were judging anonymous works, for all 235 essays were written under pseudonyms and the prizes were awarded to anonymous competitors. Only in the presence of the world's press and a few important guests were the envelopes opened and the authors' true identities revealed.

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From the pictures the reader can see what happened. He can see Max Hymans, President of Air France and Chairman of the panel for the civil aviation subject, opening the fateful envelopes. In the next picture Robert E. Gross, Chairman of Lockheed Aircraft Corporation and of the panel for the military subject, is doing likewise for the prize-winning essays on " Guided Missiles or Piloted Aircraft ? "

The surprise of press and guests when the results were announced can perhaps be imagined. Prizes went to an Australian, a Frenchman, an Englishmen, a Swiss, a team of two Italians, and an American. The sponsors also had every reason to be pleased with the results, for the prizes had been distributed over the entire globe, and there could be no question of national favouritism.

The reader of *Interavia* will sense at least something of the atmosphere of the ceremony. The sponsors hope its success will justify their decision to hold another essay competition next year, to be judged at the next Paris Air Show in 1961.

It only remains for us to thank the members of the panels for their selfless work, to congratulate the prizewinners and remember those who went unrewarded. Let us hope they will be luckier next time !

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And now let us turn to the essays by the winners of the two *Interavia* first prizes, R. W. Spurgeon of Australia and Ulrich Doerfel of Switzerland.

Air Travel for All

R. W. Spurgeon, Bentleigh, Australia, now of Wembley, Middx.

Roy W. Spurgeon, whose essay on the civil subject was awarded first prize in the Interavia Competition, has been a member of the staff of the United Kingdom Ministry of Transport and Civil Aviation since 1946. He has recently returned to England after serving for three years as Assistant Civil Aviation Adviser to the High Commissioner for the United Kingdom in Australia. He is at present employed as a Higher Executive Officer in the Ground Services section of the Ministry.

The essay subject, it will be recalled, was: " How can the airlines—in particular the European airlines—make air travel accessible to the broadest sections of the population, without endangering their economic stability ? "

Editors.

Air travel for all—four symbolic words which have been the catchphrase and goal of every protagonist of air transport since airlines first began. Everyone remembers the optimists who wrote so enthusiastically in the twenties and thirties of a future with air transport as the everyday habit of everyone, of vast masses of people catching their planes to work or travelling through a crowded sky in cars or motor cycles of the air.

So far in aviation's short span of development, these things are not with us, but no one should say that they never will be. Prediction in aviation is a dangerous game; the impossible has so often become the commonplace and it will doubtless do so again.

Today there are many parts of the world where air travel is accepted as an everyday occurrence, where passengers catch the plane as the city dweller his bus or train, but even in the most airminded of countries, the airlines are still not really in the mass transport market. In New Zealand, Australia and the USA, for instance, where the number of domestic air travellers carried each year is equivalent to nearly one in every four of the population, it is by no means true to say that a quarter of the population uses air transport. Far from it, in fact, because many of those carried travel many times during the year and, in any case, since most passengers undertake return journeys, they are already counted twice in airline statistics. An interesting study [1] of this particular subject, carried out by the Institut du Transport Aérien in 1955, concluded that in America, where over 35 million passengers were carried in 1954 when the average population was 162 million, the total number of people who actually used air transport was probably not more than 7 million, or one in every 23 persons, which is a vastly different figure, even if it is rather speculative, than one in four.

[1] Comparaison des Potentiels de Passagers Aériens des Etats-Unis et de l'Europe — Institut du Transport Aérien, Paris. (Study prepared for 2nd meeting of ECAC, Strasbourg.)

In considering, then, how the airlines should set about widening the market so as to make air travel accessible to the broadest sections of the population, it is perhaps pertinent to enquire what are the reasons which prompt people to use air transport at all. Surely the answer is that travelling by air enables them to accomplish something or to go somewhere which they either could not or would not be prepared to undertake if they were forced to rely on other means of transport. It may be the speed of air travel which makes holidays or business possible in areas beyond their reach by surface travel in the time available or it may be the extra comfort or convenience of the air journey because it is more pleasant or shorter than the comparable surface trip. But everyone knows that even though air traffic has expanded rapidly since World War II, the major factor that prevents an even faster expansion is the higher cost of air transport relative to surface travel, and we are thus faced with the inescapable and perhaps obvious conclusion that *in order to widen the present market, the airlines must somehow reduce their fares sufficiently to compete with those offered by surface transport for comparable journeys.* This accords with the growth of the air transport market to date. Air fares, in real terms, have been gradually reduced over the years; relative to surface fares, there has been a similar trend. While other public transport agencies have, in the main, been losing passengers, or at best making only slight gains, air traffic has expanded rapidly; in Europe, passenger traffic almost doubled between 1952 and 1956, and everywhere has seen the same result—reduced fares, increased traffic, a process which is continuing with the introduction of the new economy class fares on trans-Atlantic routes.

But fare reductions imply reduced costs and the generation of sufficient extra traffic to equate or improve revenue. Here the second part of the question arises—how can fares be reduced without endangering the airlines' economic stability ? It must be remembered that a proportional reduction in fares requires a more-than-proportional increase in the number of

passengers in order to provide the same revenue. For example, if fares are reduced by 25%, the number of passengers carried must increase by 33 1/3% if the same amount of revenue is to be obtained. There may sometimes be occasions when fares can be reduced even if the unit costs of transport production are not, providing sufficient extra revenue traffic can be attracted at the new fares; it is then simply a question of the elasticity of the demand for transport in any given circumstances. But fare reductions can naturally be made more easily and with less risk if unit costs can themselves be reduced.

It is easy to suggest ways in which airline costs can be reduced, particularly in Europe, but much harder to put them into practice. The most obvious method is progressive re-equipment with efficient types of aircraft for the route networks operated, in order to secure equipment with lower seat-mile operating costs than those of present aircraft. Unfortunately, the present jet re-equipment "rat-race" may prejudice this desirable object for perhaps the first time in the history of civil air transport. It appears almost certain that on typical European networks, the new jets will have higher seat-mile operating costs than those of comparable piston or turboprop engined aircraft. There is, of course, no operating experience on shorter range routes on which to base this opinion, but supporting evidence is available; it is significant, for instance, that Braniff Airways has recently asked the American CAB for a higher fare level for its forthcoming domestic jet services on the grounds that its studies have shown that on an average length of haul of just over 600 miles, the cost per available seat-mile of its Boeing 707-227's is some 19% greater than that of a DC-6 and 30% greater than a DC-7C.

It is difficult to see how, in circumstances such as these, therefore, airlines will be able to reduce their fares sufficiently to make any significant penetration into the mass market for some years. The competitive quest for speed may well result in airlines being forced to operate jet transports on many routes where a service at lower cost to the public might be offered by more conventional types. It is perhaps on these grounds that the case for fare differentials should be studied; if it is true that a section of the public will pay for extra speed because their time is so valuable, then it is equally true that many more will pay to travel somewhat slower if the price is low enough—and the block speed differences in European sectors are not going to be particularly significant to the average passenger though the jets' superiority will provide attractive advertising copy.

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There is undoubtedly a good case for much greater cooperation between European airlines in the field of investment in new aircraft so as to ensure that the maximum benefits are obtained from existing and new types. Such a policy might lessen the possibility of excess capacity being ordered for given routes and might also allow a longer period of depreciation of existing aircraft before new, competitive types are again ordered. An interesting lead in this respect has recently been given in Australia where the Government refused permission to a competing domestic airline to import new jet aircraft but sanctioned orders for new turboprop equipment. In his press announcement [2], the Minister for Civil Aviation said, *inter alia*, "The purchase of larger and faster turbine aircraft, at this stage, would stimulate a competitive race for other new turbine types, which could be disastrous to the economic stability of the industry". Cooperation between airlines of different countries not subject to a common authority is, of course, an entirely different matter and is further complicated in Europe by the competing transit operations of airlines from outside Europe, but the principle is sound and efforts to put it into practice ought not to be frustrated by the difficulties involved. With aircraft having lower seat-mile operating costs and a measure of cooperative forward planning to avoid either too much capacity or too rapid re-equipment on competitive routes, the airlines could continue to lower their fares and so bring the benefits of air transport to a wider section of the population.

But even with existing equipment, much more could be done to cut costs ; there is room for greater cooperation between airlines in other directions such as equipment interchange and pooling, common overhaul facilities and coordination of schedules. Again there are difficulties, both legal and technical, but they can be overcome if the will is strong enough. Such cooperation in Europe could well lead to better fleet utilization and a higher intensity of operating on existing routes, rather than to a continual struggle to open new and often competitive routes to new points on a radial network. Several recent studies have shown the importance of a high intensity of operations as a potent factor in cost reduction. The introduction of more off-peak and off-season fares will also contribute to this desirable result.

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A good deal remains to be done by the airlines, too, in the *field of terminal facilities*. There are many avenues for cost reduction which have not yet been as fully explored as they might have been; for instance, faster turnround, better ground handling of passengers, and, particularly, of their baggage and the elimination of other time-wasting procedures which keep aeroplanes on the ground longer than necessary when they might be producing good revenue. Some of these problems are beyond the airlines' direct control, but many are not. A good many economies also seem possible in the *cabin service* at present offered and this seems to be a matter that the airlines will have to do something about. If we are going to have air travel for all, then it must be suggested that the day of pampering the passenger is over.

There are many European routes where the flight time is so short that the full cabin service provided is quite out of proportion to the time spent by the passenger in the aircraft. Luxury meals and refreshments may have a place on certain first class and long distance flights, but it is questionable whether they are at all necessary to attract passengers on typical European routes. Apart from the reduction in the revenue payload caused by elaborate pantries and stocks of food and drink at present carried on most aircraft, turnround times could be improved if they were eliminated, the additional crew members needed to serve the meals dispensed with, their salaries saved and their places taken by additional revenue-producing passengers on most journeys of less than two or even three hours duration, depending upon times and circumstances. On flights of lesser duration, though it may be regarded as heresy to say so and there is often a statutory obligation anyway, it might be questioned whether there is really a need for any cabin crew at all; certainly NZNAC, for example, have never employed hostesses on their DC-3 flights within New Zealand involving many sectors with flight times from 1½-2 hours. What can be said without argument is that the ratio of crew to passengers in air travel is far higher than in any other form of transport and it is of little use trying to effect economies in the composition of the operating crew if the cabin crew is to increase in proportion to the number of passengers carried—and it will be borne in mind that aircraft seating capacities are increasing and flight times being reduced, all the time.

In tackling this problem, the airlines are faced with the fact that the present *system of setting fares through the IATA* rate-making machinery tends to make quality of service the major form of competition between airlines on the same route. When the fares are the same, potential travellers will naturally choose the airline with the best equipment or the best cabin or other form of service, according to taste. Thus airlines are driven to outdo each other in looking for new "gimmicks" to attract passengers and whilst this is beneficial up to a point in raising airline standards, it may ultimately result in unjustifiable cost increases.

On the other hand, the alternative to fare regulation, the rate "war" is even more unsatisfactory; it was a common experience in the formative years of air transport and was shown to have disastrous results, which no one wants to see repeated. IATA's reaction to this dilemma so far has been to prescribe the standards of cabin service and comfort which may be provided at the agreed fares, but here again increased regulation may result in desirable improvements being neglected; it may also lead to absurdities, such as the recent deliberations over the definition of a sandwich ! Fortunately, there are several other ways of solving the problem; the best seems to be one of those already advocated [3], that IATA should devise a *system of agreed fares* in which airlines are left a *fairly wide margin in the standards of service they can offer*, the variations in standards being linked to defined fare differentials. Such a system would allow airlines to please themselves whether they offered a simple service at a low fare, a luxury service at a higher fare or something in between the two.

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So far in this essay, emphasis has been laid on cost reduction as the most effective way in which air travel can be brought within the grasp of wider sections of the population, through the medium of fare reductions, but there are also other methods by which new customers can be attracted to become regular air travellers. A very great deal remains to be done, in Europe particularly, to make air travel as safe, easy and reliable as the other forms of public transport. Leaving aside the technical problems of air traffic control, navigation aids and the development of new types of equipment designed to overcome the vagaries of weather, on which research is proceeding apace, there is much the airlines can do to encourage people to regard air travel as a normal means of transport.

It will not be disputed by regular air travellers that *air transport generally is still unreliable*; there is seldom any certainty that one will be able to travel from A to B at the time when one wants to—the incoming aircraft may have been delayed, thus upsetting the schedule, weather may be too bad, there may be technical trouble, but whatever it is the prospective traveller is not interested in the cause but only in the effect. Punctuality too is more important than many airlines seem to think (and arriving early may be just as annoying as arriving late, if time has to be wasted in an airport terminal), while schedules could often be made more realistic and convenient. Similarly there is scope for greater coordination of timetables at important junction centres; very often a direct surface journey in Europe is faster because of

[2] Statement by the Australian Minister for Civil Aviation, Senator Shane Paltridge. D.C.A. Press Release—28th March, 1958.

[3] The Economics of European Air Transport—Stephen Wheatcroft—pp. 227/8—Manchester University Press, 1956.

the *bad air connections between different airlines*. Much more emphasis should be laid on passenger convenience; then perhaps Professor Parkinson [4] would not be able to observe that airlines base their timetables on the convenience of the mails rather than the passenger !

Then, too, many people still will not fly because they regard air travel as unsafe. No form of transport is entirely safe, of course, and many airlines have impeccable safety records stretching back over years of operation, but the fact remains that quite considerable sections of the population (usually among the older age-groups) regard flying as inherently unsafe. It goes without saying that airlines will always do their utmost to avoid accidents, but it is also behoves them to do more to educate the public into the acceptance of flying as a regular means of transport. To go by air is still an adventure to all but a comparative few; until it becomes as commonplace in everyone's minds as going by train or bus, the airlines will not have penetrated the mass market.

There is still too much of a " mystique " about air travel and it is apparent even in such things as reservations and ticketing. Even accepting that international travel is complicated, it surely should not always be necessary to wait for tickets to be written out every time a booking is made; for travel on high density routes at least, it ought to be possible to obtain a printed ticket at main booking offices after the style of a railway ticket. A small point perhaps and not one to discourage a potential traveller, but it is symptomatic of the atmosphere which still surrounds air travel and is something which could be made easier for the man in the street.

In the next few years, the airlines are going to have a lot of seats to fill; they are already committed to a substantial expansion of the market and in order to survive they will have to devise cheaper and less complicated operational and commercial methods. Simplicity is often the keynote of success and anything which makes life (and air travel) easier is to be applauded today; if the airlines are to make air travel accessible to the broadest sections of the community without endangering their economic stability, they must cut the frills from their service and simplify their procedures as much as they can. In fact, to modify slightly the oft-quoted words of the late Bill Stout, they must " simplicate and add more austerity " !

[4] Parkinson's Law—C. Northcote Parkinson—John Murray, 1958.

Guided Missile or Piloted Aircraft ?

by Ulrich DOERFEL, Zurich

Swiss citizen *Ulrich Doerfel*, to whom the military panel of adjudicators awarded the 1st Prize, was born in Berlin in 1923, spent his childhood in China, attended school in Switzerland and studied mechanical engineering at the Federal Institute of Technology, Zurich. He later turned to journalism and has for some years been head of the current affairs section of a photo agency.

In his letter to the *Interavia* Editors, the prize-winner explained his reasons for entering the Competition. So many of the experts who have concentrated on one particular field, he says, are apt to lose sight of the overall picture. Perhaps this was also the opinion held by the adjudicators, who apparently preferred the broader viewpoint of an author outside the profession.

The full text of the question set, it will be recalled, was " Is the piloted aircraft played out, must it abdicate in favour of the guided missile, or will the two weapons continue to exist side by side for a long time to come ? "

Editors.

With the tremendous advances now being made in the electronics field, there can be no doubt that man will in future be able to hand over a major proportion of his tasks to electronic aids. The extent of this division of labour between man and robot in the case of air vehicles, where the problem of weight is of particular importance, depends not only on technical considerations but also on a number of other factors which unfortunately are all too often ignored. Since the usefulness of any weapon can be judged only in the light of the task which it is called upon to perform, the first step should be to determine, through worldwide economic and political studies, the possible places and times at which a conflict could break out. When planning a new weapon, too, the psychological peculiarities of the potential enemy should be taken into consideration. Moreover, in view of the time span required for the creation of new weapons systems, accurate forecasts of the properties of future structural materials must be available from the outset. Allowance must also be made for the fact that different countries have very different attitudes towards human life. The Russians, for example, had no qualms about sacrificing hundreds of thousands of soldiers in mass attacks, while twenty years ago the Japanese employed bombers with suicide pilots as expendable weapons.

In the man-plus-machine systemman is merely a particularly complex piece of machinery: a combination between a relatively primitive measuring apparatus for temperature variations, sound frequencies and light waves, a computer with large storage capacity and a mechanical system with sufficient power to carry out certain control movements. The serviceability of this human equipment is limited by its sensitivity to temperature changes, accelerations, radioactive radiation and changes in the composition of the air. What is more, production—to stick to technical terminology—is a long and costly process, taking some twenty years, and can be improved upon only within very restricted limits. To what extent so versatile, but sensitive, an " equipment " can be employed by the air forces in any future war is investigated below.

By way of preface, however, the following reservations should be made. The present study is obviously intended to concern itself with the future development of military aviation. But how far is it possible, on the basis of the present technological situation, to advance predictions for the future? While rapid progress is made in one field, efforts in some other direction may come to a standstill because of insuperable

difficulties. For example, the problem set in a competition organized roughly a hundred years ago, namely for the first wireless transmission of one kilowatt of power over a distance of one kilometre, has still not been solved today. I have therefore restricted myself to examining the probable trends during the coming fifteen years—roughly the time required for the development of a completely new weapons system. Because of space limitations it has been necessary to ignore certain essential factors, which strictly speaking should be given the same amount of attention as the purely technological considerations, such as possible shifts in political power by 1975, economic changes and decisions by the uncommitted nations in favour of one or other of the two camps. Nevertheless, I have tried, at the expense of technical details (which can be obtained from technical writings), to preserve the overall relationships.

The role of the air force

In attempting to define the future roles of the air force we are embarking on a subject about which much has already been written. Giulio Douhet's theory of the air force as the decisive weapon appeared to have been confirmed in World War II: the Battle of Britain ended in a decisive defeat for the German Luftwaffe, and by the end of the war the United States had 2,340,000 men in the air forces, compared with 3,200,000 in the armies. These facts, together with the development of the atom bomb, led the West into the error, after the War, of relying solely on the strategic air force to deter a potential enemy, in the hope that this would put an end to all wars. The Korean War and the loss of Indo-China revealed the political and military fallacies inherent in this conception, while the Russian atom bomb tests and the launching of the Sputniks illustrated its technical and scientific failings. The " pistol-point " strategy has yet another major disadvantage: the Russians are in a vastly more favourable initial position for a total war of annihilation. Firstly, the USSR's population density of 9 inhabitants per square kilometre is considerable lower than that of the United States (16.5) or Europe (75); secondly, as so often in their history, the Russians have a trump card in the tremendous area of their territory (22 million square kilometres, compared with roughly 3.9 million for Europe and 9 million for the United States); thirdly, the Russians have a relatively compact target area before them whereas an American A-bomb reprisal attack could, in certain wind conditions, kill millions of Western Europeans or millions of Japanese; and fourthly there are strong Russian units in the satellite countries, whose oppressed peoples the West cannot expose to destruction.

*

It would be interesting to speculate whether the strategic air force will in fact retain any *raison d'être* in the future. In any case, however, the most urgent task remains the provision of an absolute air defence for the home territory against both manned and unmanned assailants. In addition the army must be equipped with transport aircraft to give it global mobility, with artillery rockets, with strike aircraft for direct support of the ground troops and with artificial satellites for communications and observation roles.

The strategic air force

Even today, air defence has already reached a level of efficiency where the direct employment of strategic bombers—at any rate as far as the two main opponents, Russia and America, are concerned—is beginning to be uneconomic. The next step is to keep the piloted bombers outside the range of the enemy's air defences by using stand-off bombs; but the question then arises of what advantage is to be gained by having a manned bomber to carry a missile to target proximity, when the actual release of the bomb is left to an automatic device. There is no doubt that the science of electronics will have developed reliable control and sighting systems within the next few years. The successful launching of an *Atlas* ICBM over full operational range and the precision with which another *Atlas* was placed in orbit as an earth satellite should remove the remaining obstacles now standing in the way of a conversion of SAC to guided missiles.

That the Russians have operational strategic missiles available was proved by Khrushchev's threat on November 5th, 1956, during the Suez crisis.

Apart from the technical problems, however, there is a purely human factor. With today's defence weapons in both camps, the likelihood of being shot down has risen, though the nuclear weapons carried make an attack worth while even if up to 75 percent of the attaching aircraft are destroyed. But Western ethics would not permit us to send bomber crews into battle with only a 25 percent chance of survival, at any rate until the ultimate technical resources, however costly, had been exhausted.

Air defence of the homeland

The disbalance in the reprisal strategy between East and West obliges the West to strengthen the air defence of the entire homeland as a matter of the highest urgency, if the civil population is not to be left unprotected against a devastating blow. Here, regrettably, many voices are raised against the " prohibitive " costs of such a defence. How, one asks, do these experts assess the value of a defence in dollars and cents on the one hand, and in human lives on the other? Assuming that five nuclear defence rockets at $1,250,000 each (today's price) would be needed to destroy one enemy ICBM, and that by 1968 the USSR would have one thousand operational ICBMs, we get a basic cost of $7,500 million, or to provide a fourfold security, $30,000 million. This means a total of $150 per head of the American population in 1968.

The destruction of more than 95 percent of an attacking force, such as is required in the atomic age, can be achieved only by missile carriers with air-to-air rockets or by surface-to-air missiles withatomic war heads. Europe, with a radar coverage of 250 miles, would have 15 minutes in which to defend herself against an attack by manned aircraft (and only 2 minutes against missiles). The detection and location of an enemy squadron takes some 3 to 5 minutes, transmission and evaluation of this information in the operational centre again 3 to 5 minutes, and the ascent of the most modern fighters to operating altitude yet another 5 minutes. It would be a pure matter of chance if a fighter unit happened to be patrolling just in the line of approach of the enemy formations, so that still more time would have to be added to the above before the defenders could engage the attackers. With the 96 percent lethality which can be assumed for the latest homing air-to-air rockets, a total of 80 fighters would have to be employed against a wave of 50 enemy bombers without fighter escort. It is therefore very doubtful whether the required number of fighters would really be operationally available within this roughly calculated, optimum time. In any case, fractions of a minute would decide whether the enemy bombers could be intercepted before they dropped their bombs. So much for the problem of the manned bomber. There seems no reason, however, why the Russians should not make use, for such an attack, of the many rocket weapons shown in the 1957 October parade.

Many arguments have been put forward against air defence by means of rockets, but most of them do not hold water. The first prerequisite for an effective air defence is a 100 percent early warning system (for fighters and for rockets alike), a fully automatic processing centre (for both weapons alike), target acquisition radar (for both weapons alike), guidance into target area (slightly easier for rockets), and finally the launching of the kill rocket (an automatic process for both weapons). The miserly treatment of anti-missile defence systems (*Nike-Zeus* with a range of roughly 250 miles, *Wizard* with 1,000 miles range, *Plato*) is explained in some quarters by considerations of a financial nature on the one hand and by criticism of technical details on the other. Yet it is known that technical development is making rapid strides: 1. solid-propellant motors, such as are required to ensure immediate readiness, are already available—albeit at higher cost—and research in this field

is being pressed forward intensively; 2. all electronic equipment is becoming increasingly reliable.

The more advanced technical aids become, however, the poorer a figure man cuts in competition with them; for this reason he should increasingly leave the technical execution of an order to automation and seek out for himself the most favourable place in the man/machine combination. It goes without saying that the transition to defence by means of rockets will take place only step by step, via the Mach 2 fighter and the pilotless fighter, and that both systems will continue to exist for some considerable time.

Army aviation

Air defence of the combat zone. The requirements for the air defence of the homeland and of the combat zone are so different that they demand separate examination. The home defences must perhaps stand by in readiness for years, and still be capable of going into action at full strength within a warning period of 15 minutes at the most. On the other hand, air defence of the combat zone can be included in the tactical planning and is allocated a predetermined role in the overall operations. The air umbrella over both the ground troops and the tactical air force can be provided for a certain, clearly limited period by manned missile carriers on a rotating patrol system; this will become even easier, since the foreseeable development of nuclear powerplant will give aircraft an endurance of several hundred hours. Defence against artillery rockets, as against old-style artillery bombardment, will continue to be of a passive nature for some time to come, as an active defence system for mobile troops will be too complicated in the forseeable future.

Protection of the fleets of transport aircraft required to move troops over the world-wide theatre can with advantage be entrusted to manned missile carriers. If preference is given here to the manned aircraft, this is firstly because the wide variety of tasks to be performed in direct combat operations would require a virtually impossible number of electronic aids, and secondly because the escort fighters would have to operate only against opponents of similar calibre.

The real difficulties, however, lie not in the technical problems, but in the psychological and physiological sphere. There is already an acute shortage of pilots. The following interesting solution to this problem has been proposed by Lawrence E. Morehouse [1]: as it is easier to operate a complicated piece of apparatus than to develop it, it is a waste to employ trained technicians as pilots. Technology should therefore be adapted to pilots of only average ability, so that the flying profession can be opened to wider circles and the present stringent selection standards eased. The present development trend towards increasing complication will soon make the training of fully efficient combat pilots impossible, at any rate in the Western armies based on the militia system.

The ground support air force. Assuming that the fighter units achieve air superiority at any rate for a time, it is possible to employ the ground support air force. In the present technical status of fighter development, it is impossible to equip an aircraft with the qualities of both a fighter and a ground support aircraft. The extremely high fuel consumption near the ground even makes it permissible to ask whether turboprop aircraft would not be more economical for ground support duties than jet aircraft.

In the Korean and Indo-China theatres, despite the United Nations' superiority in the air, the Communists were able to hold their positions for a full two years and even bring up cavalry units from the Yalu to the front lines. Even "Operation Strangle" (1951) was unable to prevent the enemy from carrying out routine troop movements. The reason is easily discovered: the air force operated as an independent unit, without regard for Army requirements. Only with the Marines, where the air units are an integral part of the infantry, did the ground attack pilots achieve incredible results, for example intercepting enemy attack waves 30 yards (!) in front of the UN lines.

Here lies the future of the ground support air force: operation in the closest possible collaboration with the infantry and armoured troops, right down to battalion level. It looks as if the Russians, unlike the West, have already achieved this end. Two thirds of the Russian air force are allocated to the army aviation units, which work in close cooperation with the ground troops.

Tactical aircraft which are employed against constantly changing targets in a rapidly changing situation, must be flown by human pilots.

Air transport. The more complex the art of war has become, the bigger have been the battlefields, which can now cover practically the whole globe. The question therefore arises of how concentrations are to be formed at widely differing points of the earth in time to be of use; this problem can be solved only by air transport. Even today, with transport aircraft of the Douglas C-133A or Lockheed C-130 types, to mention only two, it is possible to move troops up close to the combat zone. In future, supply rockets or nuclear-powered supply aircraft could be employed, with remote control, thus avoiding the limitations imposed by the sensitivity of the human body to accelerations, radiations, temperature and pressure variations, etc. For psychological reasons, however, troop-carrying transports will have to be supervised by human pilots.

Observation satellites. If strategy is the art of creating a particularly favourable initial position for an eventual combat, then the Russians have already achieved success on the strategic level. Their giant earth satellites, which the West has so far been unable to equal, are all too readily regarded by the military experts as scientific toys. Without going into the military speculations which see every earth satellite, or even the moon, as a launching ramp for missiles, it is already clear that a series of artificial earth satellites will be essential for the conduct of any future war: as relay stations for television and radio transmissions between widely separated combat areas, as independent early warning stations, as survey satellites, and as weather observation stations, in which capacity they will doubtless fulfil their most momentous task.

Space travel

With their nuclear powerplants and magneto-hydrodynamic propulsion systems, the engineers are already gathering together the equipment for space travel, a preliminary stage to which will be the hypersonic glider. Whether and to what extent man will be employed here, not even the experts have yet been able to agree. At the first symposium on this subject in Philadelphia in December 1957 one group argued that take-off, flight and landing should be automatically programmed, while the other proposed that man should be left his full power of decision. In any case, the military experts are aware that no air force can control the atmosphere if the space above it is in enemy hands, so that as long as space travel by man is not feasible a robot must conquer the space above the atmosphere until the results of new research enable man to follow it on what we all hope will be a peaceful mission.

[1] *Cf. Haber-Gebauer:* "Möglichkeiten und Grenzen des bemannten Fluges", published by J. A. Bart, Munich, p. 123.

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The French Electronics Industry*

by General L. M. Chassin, Paris

Part III: The Principal French Electronics Companies

Compagnie Générale de TSF (CSF), Paris, is the largest French company engaged solely in electronics. CSF and its subsidiary companies occupy a total area of over 2 millions sq. ft., employ 13,000 technicians and produce 49 percent of the total output of the electronics industry, 80 percent of the exports and 29 percent of the turnover. Apart from the parent company, the CSF group comprises the *Société française Radio-électrique* (SFR), a famous old-established firm ; *Société SADIR-Carpentier* ; *Compagnie Radio Maritime* (CRM), specializing in equipment for the merchant navy; *Compagnie Industrielle de Céramiques Electroniques* (CICE); *Condensateur Céramique* (LCC); *Compagnie Industrielle de Métaux Electroniques* (CIME); *Société de Traitements Electrolytiques et Electrothermiques* (STEL); *Compagnie d'Applications Mécaniques à l'Electronique, au Cinéma et à l'Atomistique* (CAMECA); *Centre d'Etude et de Réalisation Electronique* (CERE, Electronic research and development); *Transistor Industriel* (LTI, industrial transistors); *Radio France* (RF); *SFR Afrique* (SFRA); *Radio Orient* (RO); and the *Société Française de Documentation Electronique* (SFDE, electronic information service). Including the Italian associate *Microfarad*, this group occupies modern research laboratories at Buttes-Chaumont, Corbeville, Issy-les-Moulineaux and Puteaux, employing a total of 2,000 engineers and technicians; by January 1st, 1959, the CSF group had applied for 1,532 foreign patents, of which 460 were in the USA, 305 in the UK, 275 in Germany and 115 in Italy.

The CSF has several factories in the Paris area (at Malakoff, Montreuil, Montrouge, Courbevoie, Corbeil, Levallois) and in the provinces (works at Cholet for small components, and at Ste. Egrève, near Grenoble, where transistors are made). There are also a number of research establishments near Paris, notably Cormeille (specializing in antennas), Pontoise (radar), Houilles (transmitters) etc.; CSF products are exported to 24 different countries including the United States and Russia.

Apart from territorial air defence radar systems used in France and abroad, one of which is the ER 37, the first French radar to have exceeded 1 MW capacity, CSF also manufacturers a complete range of radar equipment, including fire control radar, antennas and panoramic indicator systems, etc.

The FAA has ordered the Ti 440 image converter (incorporating the TMA 403X " memory " tube known to Americans as " Frenchicon ") for use on airports under its control, and the British have christened another CSF product, the carcinotron, " a damned French invention " because of its jamming potential over a wide frequency range; the carcinotron is a microwave oscillator and was designed and developed by *Mr. Warnecke*, Director of the CSF Technical Research Station at Corbeville Castle. It would be no exaggeration to say that this instrument has immense future possibilities.

In the nuclear field, CSF is also working on linear accelerators, spectrometers, computers, reactor control, personnel protection, electronic microwaves etc. Production of nucleonic material which will soon be used in aviation includes manufacture by the Van Arkel process of 54-lb ingots of pure zirconium, and the successful purifying of thorium.

CIME manufactures heavy tungsten-nickel-copper alloys known as Inermet, SV 50 alloys for welding on glass, nickel for thermoelectronic cathodes, and DP 55 magnetic alloys. Series production at *CICE* includes sintered metals for thermistors and non-linear resistances for voltage regulation. New semi-conductors of sintered/bismuth/tellurium and sintered/zinc/antimony have been developed for solar generating cells. *LCC* is carrying out research on dielectric HQ 1 HK ceramics for up to 200°C and wound and circular ceramic condensers.

CSF valve production is particularly extensive including, apart from Frenchicons and carcinotrons, " miniatron " and " subnitron " valves, ultra-rapid and travelling wave modulators, and geiger counters. The semi-conductor department makes germanium point and junction diodes; miniature high and low capacity glass transistors, particularly high-capacity units of silicon; silicon diodes; and photo-diode cells of germanium. Also produced are very high voltage quartz crystals, transistorized miniature quartz pilot valves, quartz filters from 84 k/cs to 13 Mc/s and thermostatically controlled heaters regulating crystal temperatures to $\pm 0.1°$ Cent.

CSF is also actively concerned with aviation and marine radio navigation. NATO recently invited proposals for construction of an early warning radar system for Western Europe, extending from Norway to Turkey, and the project submitted by CSF has been adopted.

The airborne Cyrano fire control system for the *Mirage III C* is being produced by CSF, which already markets two transistorized items, the RC232 radio-compass and the AM220 radio-altimeter. The advantages of transistors are especially apparent in the RC232, which weighs 12 lb. as compared to older models weighing 40 lb. and requires 0.4 A. at 27 volts instead of 9 or 10 amps.

A full range of transceivers is also available and particularly important items include a UHF 1,750 channel transceiver; an automatic landing system; and a bombsight with radar ranging for LABS.

Finally, the company also manufactures pulsed and frequency-modulated radio link equipment on metric, decimetric and centimetric bands for static and mobile stations.

A famous engineer, *M. Ponté*, is Managing Director of this entirely French company which is a powerful and prosperous element of the new electronics industry in France.

*

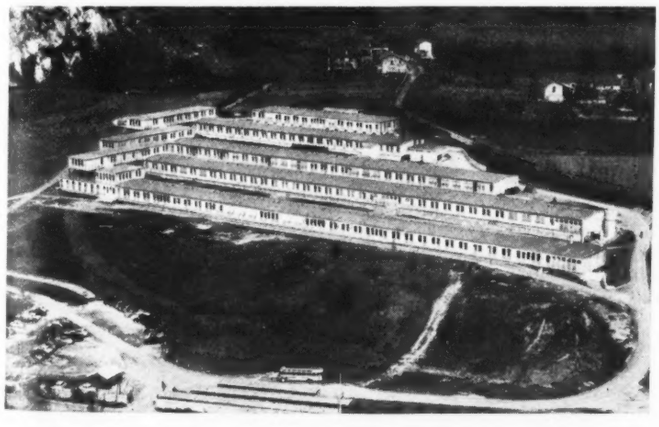
Compagnie Française Thomson-Houston was founded in 1893 and has been interested in low voltage equipment since 1936. An electronic section was formed in 1945 and this developed rapidly, particularly in radar techniques, until 1955 when it was decided to concentrate practically all the company's technical activities on electronics. A new and imposing research centre has been built at Bagneux, a few miles south of Paris, and prototypes of new equipment and instruments have been designed and built there since these magnificent laboratories opened in 1958.

CFTH now has a factory area of some 2 million sq. ft. and employs 14,000 personnel. The electronics section is autonomous, with 6,000 employees and 900,000 sq. ft. of factories, laboratories and production departments. The turnover for 1957 was 2.4 million dollars. Included in the electronics section are the commercial division and divisions for electronic equipment, electronic tubes, nuclear research, and semi-conductors.

Factories are situated at Paris, St.-Ouen, Gennevilliers and at Angers. The latter is a new plant employing 2,000 people on radio and television production and is part of the increasingly necessary process of decentralization. The research laboratories are at Bayonne, Longjumeau, Villeneuve-la-Garenne and at Christ-de-Saclay. Finally, *Société Nouvelle d'Electronique* (1,000 employees), which had already taken over the radar side of *Radio-Industrie*, has now become a subsidiary of C.F.T.H.

* Conclusion of a previous article by the same author which appeared in INTERAVIA, No. 6, 1959, pp. 637-640.

The new CSF factory at St. Egrève near Grenoble, where a wide range of electronic valves and components used in civil and military aviation are made.



Thomson-Houston research activities are now centred in ultra-modern laboratories at Bagneux, south of Paris.

Broadly speaking, Thomson-Houston manufactures the same range of equipment as CSF: radio communications, radar, electronic valves, semiconductors, nucleonics, weapons systems and missile equipment. Of particular interest is the COT/AL radar fire control system for ground AA defence, which has been produced in large quantities under an offshore contract, and has a detection range of 40 miles and plots automatically over 30 miles. COT/AL TH.D. 1280 has a higher performance and can be used against supersonic aircraft and missiles. It is designed to withstand all climatic conditions and is entirely mobile when installed on a special heavy-duty articulated transporter. Thomson-Houston surveillance and precision approach radar are installed at a large number of civil and NATO airports in France (Orly, Le Bourget), Belgium (Brussels), Italy (Milan), Switzerland (Geneva), Denmark (Copenhagen), Germany, North Africa etc. The SRE radar system has a large TH D214 antenna and a 1 MW variable-frequency magnetron transmitter model TH D179; it can plot a twin-engined aircraft travelling at 39,000 ft. up to a distance of 90 miles.

This company has also developed a number of transceivers for aviation and marine purposes, of which the best known is the 5 MW fixed-frequency radar; other specialized equipment includes all types of antenna for 23 cm and 10 cm radars, PPI for radar installations, and precision approach radar (PAR) in service at many airports.

Items in the range of radio communication equipment are portable emergency transceivers; the TH C 985/6 beacon which is, in fact, a very small transistorized UHF transceiver weighing 1 lb, powered by batteries, and with a range of over 65 miles; BLU single-sideband 100 watt transceivers, model TH C 888, 10 watt input, range several hundred miles and weighing 120 lb; radio link and forward-scatter systems. CFTH is one of the largest manufacturers of valves and transistors in France, and the company has also developed methods of producing germanium and silicon crystals, and multi-point transistors, which now compete on equal terms in the French market with similar items of American manufacture. The Armament and Missiles Division is developing guidance and remote control systems for air-to-air and ground-to-air missiles. Thomson-Houston has been active in the international corporation SETEL which will produce components and sub-assemblies of the *Hawk* surface-to-air missile which is now to be manufactured in Europe under NATO's *Hawk Production Organization*.

*

Another important company is **Le Matériel Téléphonique (LMT)**, Boulogne-Billancourt, which has long applied the principles of electronics in telephone, radio and television systems. LMT markets VHF radio telephones for police forces, taxis and other civilian users, with other models specially designed for military communications. Development of air navigation equipment was begun before the last war when the first direction finders were produced; more recently, the CRD 6 system has become available, and the company is now working for NATO on the TACAN medium-range navigation system. Several types of beacon are being manufactured, particularly the CNR 9 for the armed forces and units of from 1 to 10 kw for civil aviation, and LMT is collaborating with the German company *Standard Elektrik Lorenz AG* on production of airborne ARN 21 stations for the combined needs of France and Germany.

Another product of interest to aviation is the LMT 141 blind-flying static trainer which has been used for several years to train French aircrews; a more recent development is a *Mirage III C* aircraft simulator, of which a one-fifth scale model was on view at the Paris Air Show.

In the course of its normal production activities, LMT has developed very advanced techniques in electronics, computation and automation with the result that the company is now expert in electronic guidance systems and all types of ancillary ground equipment for missiles.

*

Société Nouvelle d'Electronique (SNE), Paris, was formed in 1957 as a subsidiary of Thomson-Houston to take over and combine the radar and electronic departments of two older companies, the *Société Nouvelle de l'Outillage RBV*, and *Radio-Industrie*.

The company's facilities include a laboratory in Paris carrying out research on radar antennas, data analysers and computers, a factory at Sartrouville, and a proving ground at Limours. The total area occupied exceeds 700,000 sq. ft., and the personnel of about 1,000 includes a large proportion of engineers.

SNE specializes, inter alia, in multi-beam antennas for long-range radar systems; antennas for three dimensional radar (this type is unique in Europe), and back-to-back antennas specially designed for large airports.

SNE also devotes a major part of its activities to the development of video information systems. These cover a very wide range of equipment, running from conventional indicators (with fixed or moving coils) to automatic or semi-automatic systems using digital computers.

*

The electronics section of the **Générale Aéronautique Marcel Dassault (GAMD)** was formed in January 1955; six months later, the first Aladin radar was airborne. The Aladin radar was developed by the company for installation as one unit in the front of the fuselage thus avoiding the well-known black boxes of evil repute. A much more complex twin automatic fire control system, the Super-Aïda, was designed and produced in less than six months in 1958.

The electronics section of GAMD is currently developing and constructing Aïda Mark 7B, Aïda Mark 3D (for the Naval Air Arm's *Etendard IV*) and the Super Aïda system already mentioned. Other important items of military equipment are electronic detectors and jamming devices, and the company is collaborating with other firms in the production of electromagnetic components for air-to-air missiles (homing heads, responders etc.). The automation and electronics departments are also combining forces in the development of electrically controlled stabilizers for modern aircraft.

At least two-thirds of the employees working for the electronics section, of which more than 80 are engineers or senior grades, are engaged in development and prototype construction, the remainder being responsible for series production.

*

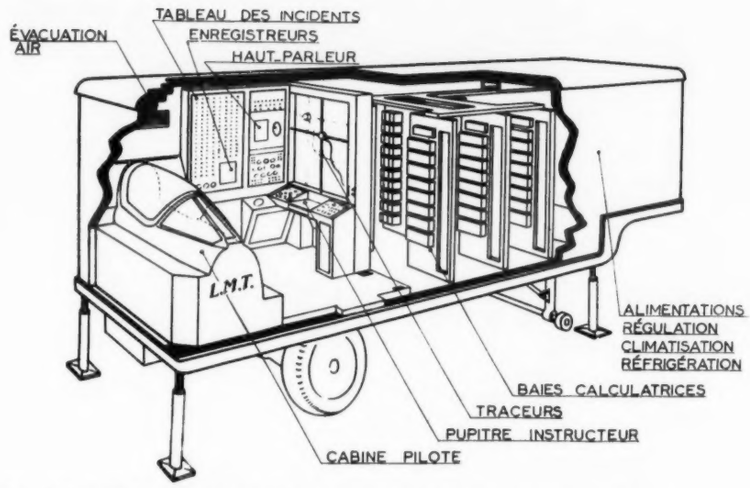
Several items of particular interest to aviation are included in the wide range of control and regulation equipment marketed by **Compagnie des Compteurs,** Montrouge. The technique of radar has been applied in developing a ceiling projector which is now standard equipment for calculating cloud heights; this instrument computes the altitude by measuring the delay between transmission and reception of a light beam reflected from the cloud mass. Two types of meter are available, the TNR for ranges between 100 and 5,000 ft to within ±30 ft and the lighter TNS for ceilings between 65 and 1,200 ft.

Operational tests are in progress on another instrument which uses the same principle as the TNR but which measures visibility by comparing light intensities. A beam is transmitted obliquely to an altitude of 200 ft; the beam is reflected by the atmosphere to two receivers which simulate beacon visibility.

The Eram magnetic tape recorder repeats spoken messages of 3 to 5 minutes duration, such as meteorological forecasts, for use in control towers. The company has also applied advanced techniques in magnetic recording to the development of digital and analogue recorders such as the model PP2 which collects and reproduces data obtained during flight or wind-tunnel testing. Another specialized item is the RANA radio navigation system, based on the principle of frequency differential measurement and designed for use in restricted channels and other congested sea lanes.

*

The CSF type Ti 440 image converter incorporates the Frenchicon " memory " tube which enables an image to be read off a television tube, shown here in the control tower at Paris-Orly airport.



Sketch of the *Mirage III C* mobile flight simulator developed by LMT *(Le Matériel Téléphonique)*.

The old-established **Société Alsacienne de Constructions Mécaniques (SACM),** Paris, now possesses an active and rapidly expanding electronic telecommunications and nuclear energy department with laboratories at Paris and Montrouge and factories at Arcueil, Clichy, Annecy and Lille.

VHF and UHF equipment for aviation includes a short-range monopulse detector radar, complex antenna couplings and various measuring instruments. The company is also producing electronic computers for use with Navy and Air Force aircraft and missile guidance systems.

*

Société d'Optique, de Mécanique, d'Electricité et de Radio (OMERA), Argenteuil, is principally engaged in manufacture under licence of equipment developed by SARAM, an old company well-known in French aviation for its excellent type 5-41, 5-42 and 5-52 VHF transceivers. OMERA is currently concentrating on airborne UHF receivers, and the most recent model is the small and very light SARAM type TRAP IIA. Swedish AGA beacons are also made under licence and a small type WF 1 Decca radar for measuring wind speed and direction is in production for the French meteorological service.

*

Formed in 1945, the **Société d'Electronique et d'Automatisme (SEA),** Courbevoie, Seine, specializes in electronic digital and analogue computers. The company has a factory at Courbevoie covering an area of 90,000 sq. ft., has applied for 600 patents, and is divided into five main sections: analogue computers; training simulators; digital computers; industrial applications and automation; and Creed-type telegraphy systems. An item in current production is a *Vautour* flight simulator.

*

Société de Fabrication d'Instruments de Mesures (SFIM), Palaiseau, Seine-et-Oise, is a comparatively new company employing about 700 people, with factories at Massy and Palaiseau, and specializing in airborne measuring instruments such as visual indicators, potentiometers and Machmeters. Other types of apparatus manufactured include ADF equipment, vertical and directional gyros and oxygen flow regulators. A recent product is an integrating gyro; the company is very interested in radio navigation because the Technical Director is none other than Colonel P. C. Gaudillère, the inventor of the Radio-Mesh (Radio-Mailles) system which probably has a vast international potential.

*

Société Industrielle des Nouvelles Techniques Radio Electriques (SINTRA), Asnières, Seine, specializes in the radar simulator already mentioned and in the STRIDA system for automatic radar image transmission. Very satisfactory tests have been carried out on STRIDA 2 developed to give automatic control of a French light interceptor aircraft, and the semi-automatic STRIDA 1B has been ordered by the French air force.

*

Other companies interested in the aviation industry are **Bronzavia** (VHF transceivers and instruments), **Radio AIR** (HF and MF airborne transmitters), **Télécommunications-Radioélectricité et Téléphone (TRT)** specializing in Link trainers and tank telecommunication equipment, **STERA** (antennas) and, finally, **IBM (France)** which has recently formed a research centre for the study of problems in aviation and guided missiles.

Part IV: Trends in the French Electronics Industry

Apart from steady progress in the scientific and industrial fields, the application of electronics to aviation is following well-defined lines.

1. *Miniaturization :* The need for smaller and lighter components has increased enormously since the advent of missiles, and consequently it is now more usual to employ semi-conductors in place of the more cumbersome miniature valves. Transistors have a particularly marked effect on the electronics industry, and although production has gradually increased to millions every year, the supply still does not meet the demand. The extremely small apparatus made possible by transistors involves the use of special skills, such as those found in watchmaking, instead of the mechanical aptitudes previously required.

2. *Automation :* The science of electronics has given a new lease of life to automation and computer systems which, basically, can provide an infallible answer to any problem or series of problems by the simple process of eliminating everything except the correct solution. Such systems are particularly useful in analysing data of all kinds and establishing the reasons for error. Without computers, accurate fire control radar would be impossible and they are equally important components of navigation and guidance systems of all kinds.

Although the analogue computer is normally used to analyse a specific type of problem, digital computers can deal with a great variety of data and since transistors have been available, they are much smaller than they used to be. Computers are an essential part of airborne systems now being used for automatic pilots, flight directors, stabilized platforms, flight and navigation control (such as the Bell automatic landing system and Radio-Mesh).

Electronic computers are also used for plotting fixes, using speed information supplied by a Doppler radar, aerodynamic data and wind vector, or an inertial navigation system; finally, they are incorporated in ground control posts of the SAGE or SATCO types.

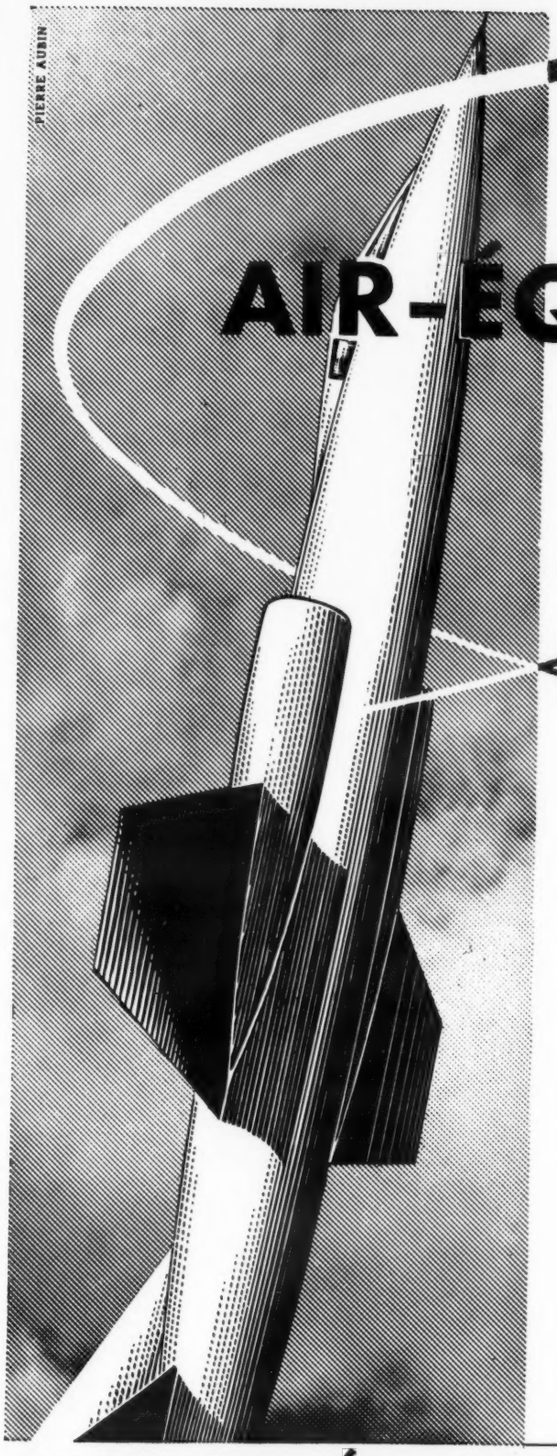
3. *Missiles and Satellites :* Electronic apparatus of all kinds is being adapted for use in missiles and satellites and the most stringent tests are made to ensure that equipment can withstand the high temperatures and accelerations involved. Some problems, such as automatic guidance, remote control, telemetry and power are particularly important in guided missiles, and in France, as in the United States, the development of solar cells is progressing satisfactorily.

4. *Checking components :* The electronics industry is giving more and more attention to this problem. Future missiles and satellites will have tens or, perhaps, hundreds of thousands of components, and each of these will have to function perfectly if serious breakdowns are to be avoided. At the moment, the reliability of parts is unfortunately not keeping pace with technical progress in equipment, and the trouble free working life of military materials is still very short. In this connection, the United States Air Force gives the figures of 80 hours useful life for HF transmitters, 70 hours for UHF transmitters, and only 16 hours for computers. " The Air Force spends about 2 dollars per annum for the maintenance of 1 dollars' worth of electronic equipment for aerial navigation. Thus, from 1 to 10 times the original cost is spent to maintain each item during its useful life."

In an attempt to make electronic apparatus more reliable, all companies have formed special departments to check, standardize and test parts. Large numbers of inspectors are engaged in this work which involves an expenditure roughly equivalent to 7 or 8% of the price of the components.

Conclusion

In France, as in every other country, the science of electronics applied to aviation is expanding continuously. As speeds are increased the human brain cannot cope with all the many complex problems which arise in piloting, bombing, firing, or even navigation, without the aid of automation. In future aircraft, human activity might be reduced to watching dials and pushing the right button to start a complicated sequence of events which may well be incomprehensible to the operator. With the evolution of the missile, man is being entirely replaced by the miracle of electronics. Combining brain-power, quality production and heavy financial investment, the electronics industry in France, which is also a source of revenue for the State, must be protected. The future holds immense possibilities and the industry, guided by industrialists and engineers of the highest quality, has already done much to maintain the prestige of France.



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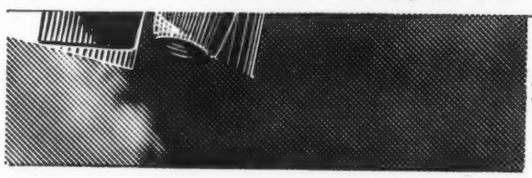
DIVISION **AIR-ÉQUIPEMENT** de la Sté D.B.A.



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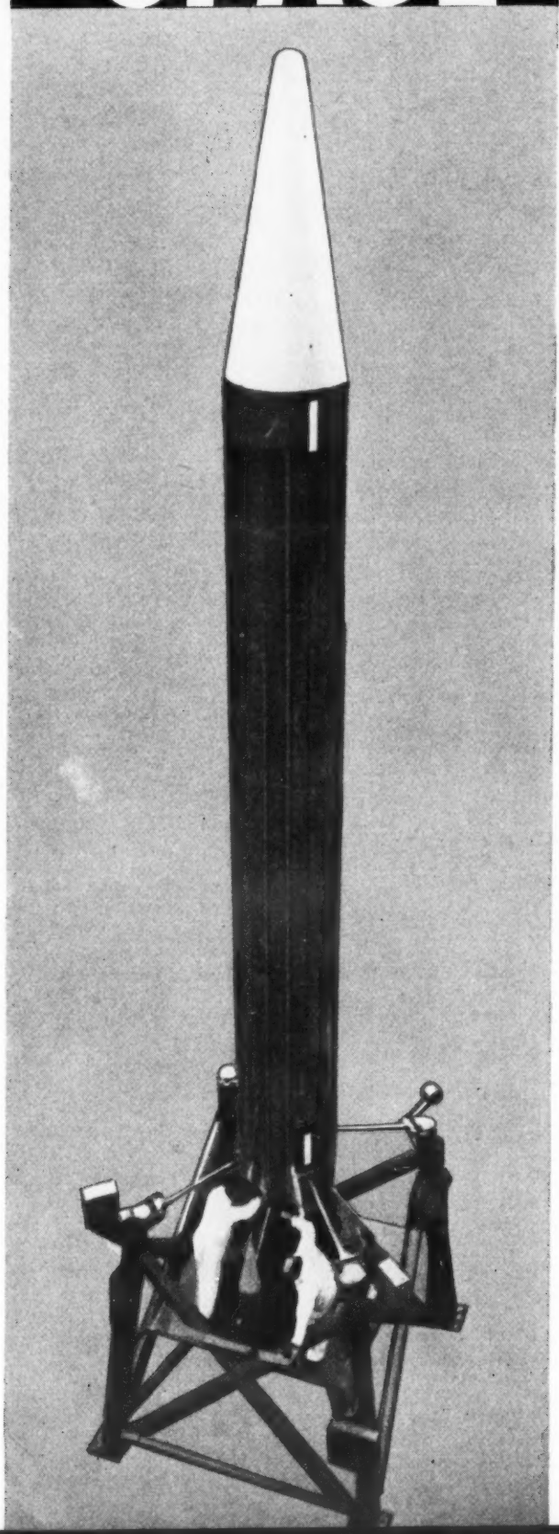


BRISTOL SIDDELEY GAMMA ROCKET ENGINE POWERS BLACK KNIGHT- BRITAIN'S HIGHLY SUCCESSFUL SPACE RESEARCH VEHICLE

On the 11th June, 19,000 lb of thrust sent Black Knight to the threshold of outer space—500 miles above the Woomera rocket range in Australia.

This was the third successful firing *(there have been no failures)* and much of the credit for Black Knight's trouble-free performance must be given to the Gamma.

The Bristol Siddeley Gamma 201 is a liquid propellant rocket engine. Four trunnion-mounted chambers burn kerosene with HTP and each chamber is fed by its own turbopump unit. The complete weight of the engine compartment is less than 700 lb (dry) and Gamma delivers 19,000 lb at altitude—16,400 lb at sea level.

Black Knight is a research vehicle and no military applications are planned. But the experience gained and lessons learned from this highly successful space probe will be invaluable in the development of Britain's IRBM—Blue Streak.

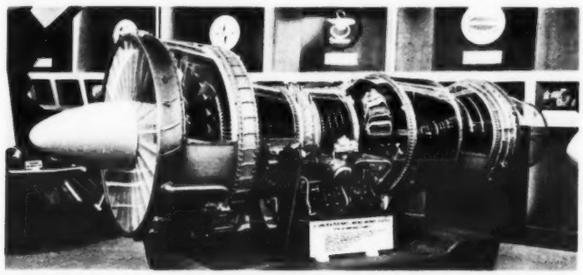
So impressive is Black Knight's performance with the Gamma powerplant that even more advanced applications are being actively developed. In fact, Black Knight coupled with Blue Streak is first choice to put Britain's projected space satellite into orbit.

BRISTOL SIDDELEY ENGINES LIMITED

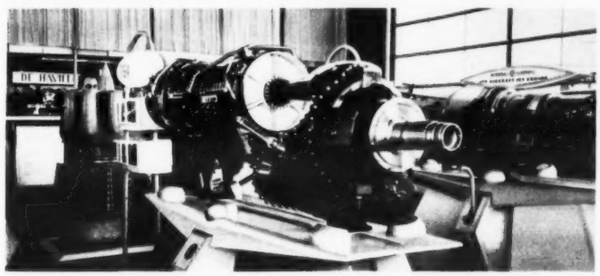
Aircraft Engines at Le Bourget

The wealth of gas turbines and piston engines exhibited at the 23rd Paris Air Show makes it impossible to describe them in detail here, though more information on the new designs will appear in the next issue on engines. From the selection of pictures reproduced in these pages the reader can, however, see for himself the great variety of engine exhibits at this year's Air Show, where a striking number of by-pass or turbofan engines were displayed on the stands of Pratt & Whitney, General Electric, Rolls-Royce, Turboméca etc.

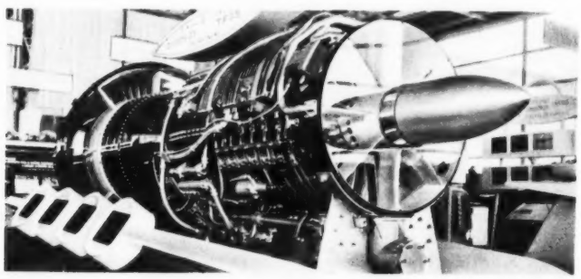
France: The Turboméca *Bastan* propeller turbine with a take-off rating of 800/1000 e.h.p. at a consumption of 518 lb/hr; weight with full accessories and propeller 770 lb. To the left the *Artouste II* turboshaft engine, whose IIC version has a take-off rating of 400 h.p. and a maximum continuous power of 360 h.p.; installed weight of the *Artouste IIC* is 262 lb.



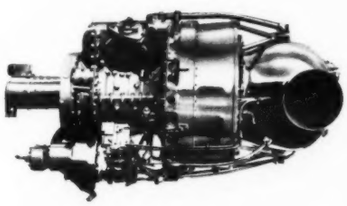
The Pratt & Whitney JT3D (TF33) turbojet with front fan; 17,000 lb thrust class. — Also exhibited on the United Aircraft stand were the JT4A jet engine (16,800 lb thrust class), the JT8 (J52) for guided missiles and smaller military aircraft (7,500 lb thrust class) and JT-12 (J60) in the 3,000 lb thrust class.



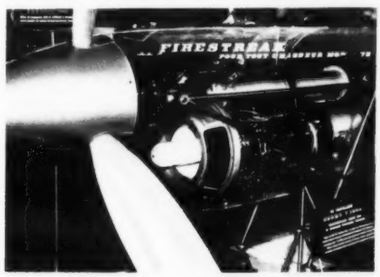
USA: General Electric Co. was represented at Le Bourget by examples of its entire engine production: the T58 turboshaft engine (GE-6 version 1,050 s.h.p.; GE-8 version 1,250 s.h.p.) for helicopters and STOL aircraft; J85 jet in the 2,000 lb thrust class; T64 turboprop/turboshaft engine which can be used for driving propellers or for equipping helicopters etc. (the T64-GE-4 turboprop version delivers 2,570 e.h.p.). Also the CJ-805 ducted fan engine and the GE J79 high power jet engine in the 15,000 lb. thrust class.



USA: The General Electric CJ805-23 (TF35) with aft fan; 15,000 lb. thrust class.

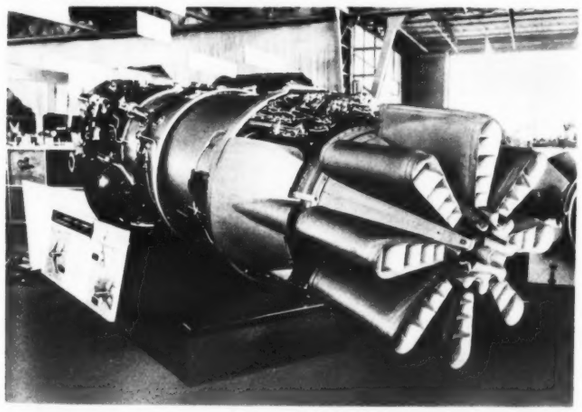


Great Britain: The Bristol Siddeley P.181 turboshaft engine, developed primarily for use in helicopters and STOL aircraft. Take-off rating 1,020 s.h.p. plus 200 lb residual thrust.

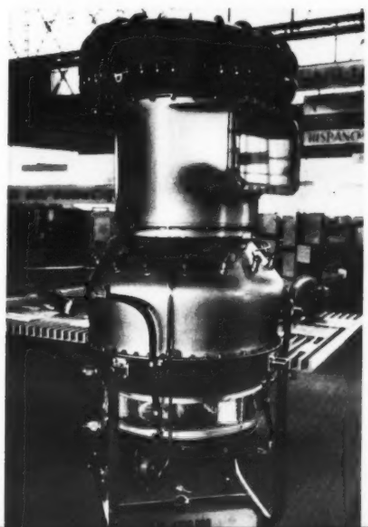


Great Britain: The de Havilland P.1000 *Gnome* propeller turbine (rating 1,000–1,400 s.h.p.). A turboshaft version of this engine for use in helicopters (e.g. the Agusta 101G) is also being built.

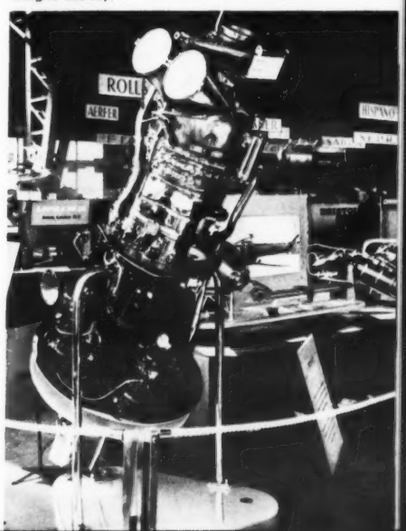
Great Britain: The most powerful engine on the Rolls-Royce stand was this *Conway RCo.10*, which delivers a guaranteed minimum dry thrust of 16,500 lb and is fitted, for example, in the Boeing 707-420 transport aircraft.

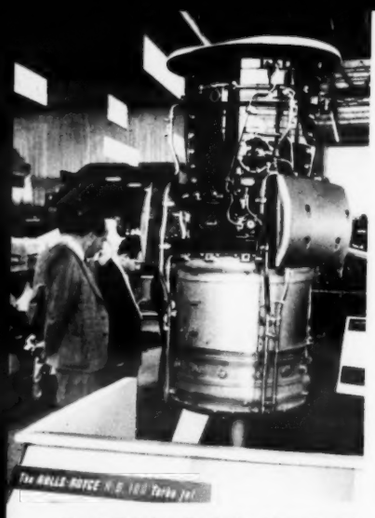


Italy: The Fiat 4700,000 turbo-compressor (680 h.p. shaft power) which is to equip the Fiat 7002 helicopter at present under construction.

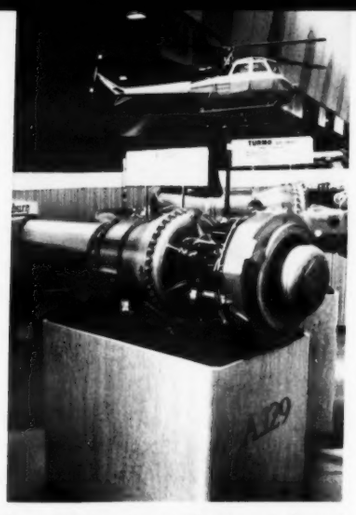


Great Britain: The Westland *Wessex* and the Bristol 192 are among the helicopters to be fitted with this Napier *Gazelle* free turbine engine (1,450 h.p. one-hour power, installed weight 865 lb).

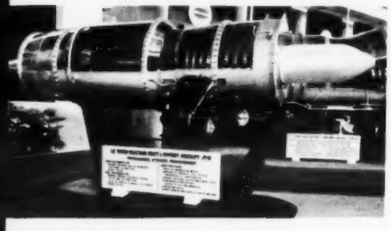




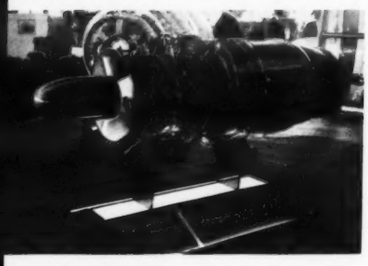
Great Britain: Particular interest was aroused by the Rolls-Royce **RB.108** jet engine (2,010 lb thrust at approx. 250 lb dry weight) specially developed for use in **VTOL** and **STOL** aircraft. The Short **SC.1** experimental **VTOL** aircraft is powered by five **RB.108s.**



Great Britain: Among Blackburn & General Aircraft's exhibits was this new **A.129** free turbine engine in the 800/850 s.h.p. class. The A.129's performance is to be increased to 970 s.h.p. within the foreseeable future, and it is also intended to develop a turboprop version.



USA: The Pratt & Whitney JT-12 (J60), whose version without reheat delivers a sea level thrust of about 3,000 lb for an installed weight of 430 lb; the sea level thrust of the reheat version is about 4,400 lb, the installed weight 645 lb. At a speed of Mach 2 and a height of 35,000 ft. this engine's thrust is expected to be 4,900 lb. The JT-12 or J60 is designed for installation in the North American *Sabreliner*, the Lockheed *JetStar*, the McDonnell 119 and various target drones.

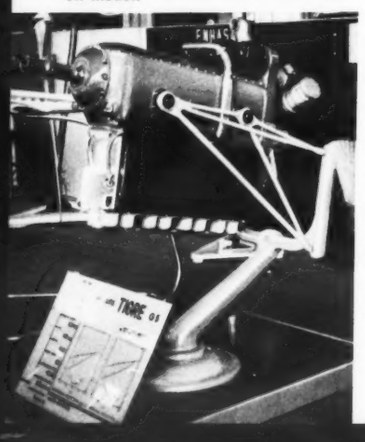


Great Britain: The Bristol Siddeley Viper *ASV 11* of 2,500 lb static thrust; installed weight 500 lb.

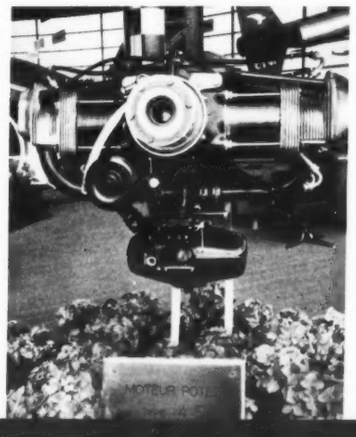
Great Britain: The **BOr. 12**, latest version of the Bristol *Orpheus* lightweight jet engine, was on show on the Bristol Siddeley stand. Without reheat the **BOr. 12's** thrust is 6,810 lb; with reheat thrusts up to 8,650 lb have already been achieved.

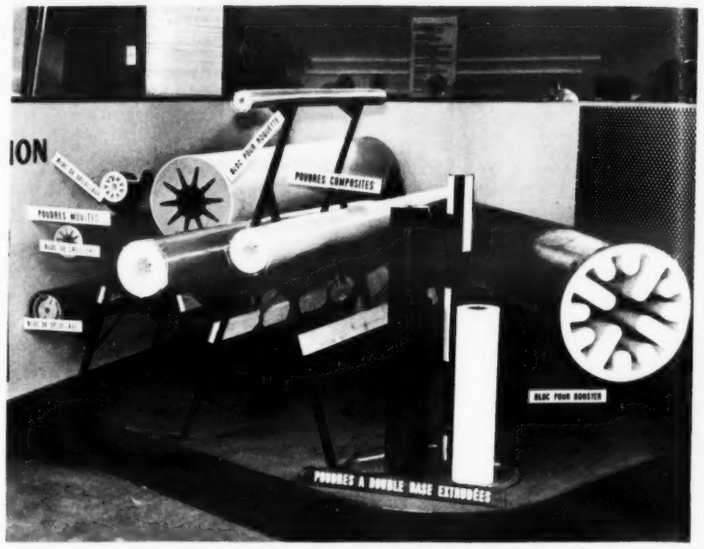
France: Among **SNECMA's** exhibits was the **ATAR 9** high power jet engine which delivers a maximum thrust of 9,370 lb without and 13,230 lb with reheat. The **ATAR 9** powers the Dassault *Mirage IIIA* supersonic fighter. A more powerful, reheat version of the **ATAR 9** with 14,100 lb thrust is envisaged for the *Mirage IIIC*.

Spain: Small *Tigre G5* aircraft engine built by Empresa Nacional de Motores de Aviación S. A. (ENMASA); this four-cylinder air-cooled in-line engine has a rating of 125 to 150 h.p. depending on model.



France: Also shown for the first time at Le Bourget was the Potez 4E 90 h.p. four-cylinder opposed type engine; installed weight 198 lb.





The Service des Poudres of the French Defence Ministry exhibited cast and extruded propellant charges for solid fuel rockets and gave a glimpse into the production of dual-based and mixed charges; they are produced, as is also the case with all liquid propellants in France, solely by the Service des Poudres. To the right of the picture is a large booster block, in the centre (in vertical position) are several dual-based extruded propellant charges, and to the left are cast charges for short-burning boosters and longer-burning motors for cruising.

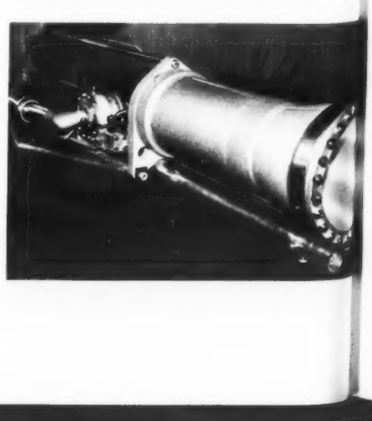
Motors for

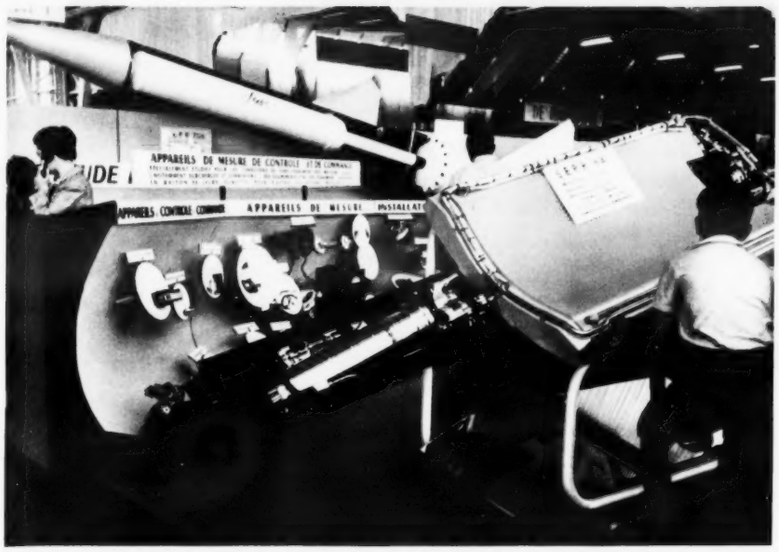
That today's guided missiles, whether large or small, rely almost solely on jet propulsion, is hardly surprising in view of the high speeds and great weights of these generally expendable weapons. But who, only a few years ago could have forecast the role rocket motors, particularly those using solid propellants, would play today? Wherever there is the need for a cheap powerplant or the generation of high thrusts for short periods, the rocket motor has won pride of place; it is especially valuable as a powerplant for missiles needing considerable thrusts in high-altitude regions where air is thin, or outside the earth's atmosphere altogether.

Not only did the 23rd Paris Air Show give the most comprehensive display of jet engines and gas turbines ever on view to the general public, but, what is more, it presented a whole range of rocket motors from an auxiliary rocket weighing only a few grammes for emergency opening of parachutes to the mighty *Thor* **IRBM** rocket motor with a ground thrust of 160,000 lb. A further striking feature of the Paris exhibition was the leading role played by the solid fuel rocket motor in tactical missiles. In countless laboratories chemists are working on new combinations of propellants to compress still greater energies into the smallest possible volumes at minimum weights.

It is only right and proper that the accompanying picture report should include ramjet engines, for nearly a dozen of the surface-to-air weapons and target drones on show were powered by this means to achieve maximum range at high altitude.

Svenska Flygmotor AB showed its new **RR.2** ramjet (picture on left shows intake diffusor with fuel injection system) and the **VR.3** liquid propellant engine. The **RR.2's** dual-shock diffusor was designed for operating speeds of about Mach 3, and the whole engine is to be fitted to a guided weapon as yet unnamed. The **VR.3** rocket engine has an installed weight of 165.3 lb. and at heights of about 65,000 ft. delivers a thrust of 5,732 lb. It is intended as an auxiliary powerplant for manned fighters, but could also be used for a new air-to-surface weapon.



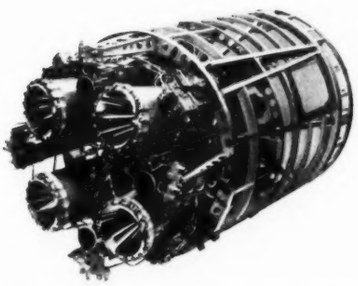


Centre piece of the Société d'Etude de la Propulsion par Réaction (SEPR) stand: Type 841 liquid propellant engine with flat integral propellant tank for incorporation in the fuselage belly of the *Mirage III* supersonic fighter. The engine, which can be set to two thrust stages (3,300 and 1,650 lb.), is now in production by Hispano-Suiza. At the back of the stand is the SEPR 706 solid fuel motor (3,527 lb. thrust) for the MATRA 422 surface-to-air missile, mounted on the SEPR 734 booster (25.6 tons thrust) to the right.

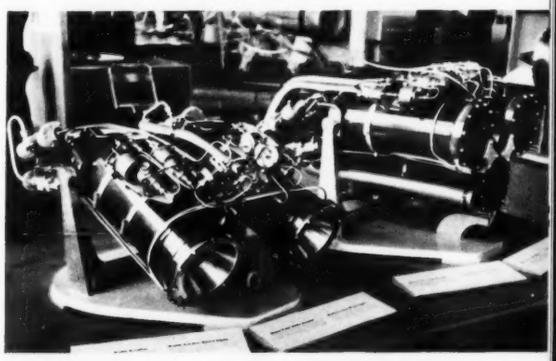
Nord Aviation's systematic research in the field of ramjet propulsion has led to the creation of the ST. 450 experimental air-breathing missile with integral ramjet (right) and the ST. 600 ramjet motor, newly designated *Sirius I* (left). Whereas the ST. 450 reached a record speed of Mach 3.6 and a height of about 85,000 ft. during climbing tests, the *Sirius* is designed for sustained flight at high altitudes at speeds between Mach 1.5 and 2.5. Near the ground, at Mach 2, the ramjet, which weighs only 312.6 lb., delivers a thrust of 13,230 lb., and at a speed of Mach 2.5 and a height of about 65,000 ft. about 1,100 lb.

Guided Weapons

The SEPR solid fuel booster with a total impulse of 48 secton and a thrust of 11 tons, for launching the new Sud-Aviation 4500 surface-to-surface guided missile. The booster has two separate propellant charge casings, each containing two charges, one burning forwards and the other backwards. The exhaust gases are captured in a collector and ejected through a single nozzle between the two casings.

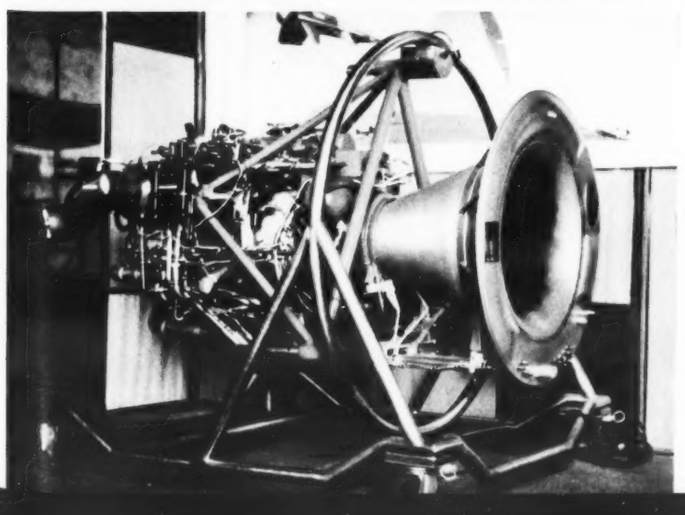


The Bristol-Siddeley 201 *Gamma* liquid propellant engine has carried the Saro *Black Knight* experimental missile to satellite altitude on four occasions. The four combustion chambers may be regulated separately and continuously and permit control of the thrust vector without gimballing. The ground thrust of the *Gamma* is 16,400 lb., the altitude thrust up to 19,000 lb. and the dry weight about 700 lb.

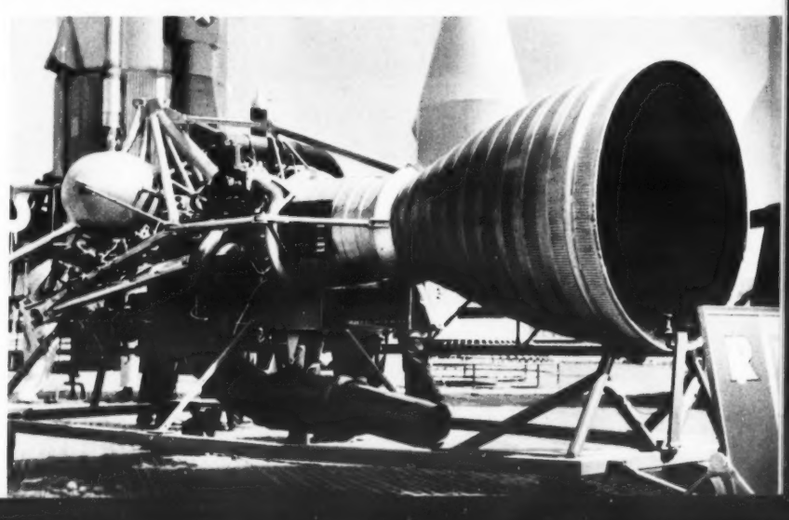


Napier exhibited the NSc.D1 *Double Scorpion* (left) and NSc.T1 *Triple Scorpion*. Both engines use high test peroxide and kerosene and are regeneratively cooled; a peroxide steam generator and two centrifugal pumps form the propellant feed system. The NSc.D1 is now in production as an auxiliary engine for the English Electric P.1B supersonic fighter.

Among the American space travel exhibits Thiokol's Reaction Motors Division showed the XLR 99-RM-2 *Pioneer* liquid propellant rocket engine which powers the North American X-15 hypersonic research aircraft, also exhibited. This continuously governable single-chamber engine is designed to use lox and anhydrous ammonium as propellants, and its final version is to deliver an altitude thrust of 60,000 lb. Striking features are the large number of ducts, valves and other auxiliary equipment and the widely-flaring opening of the thrust nozzle.

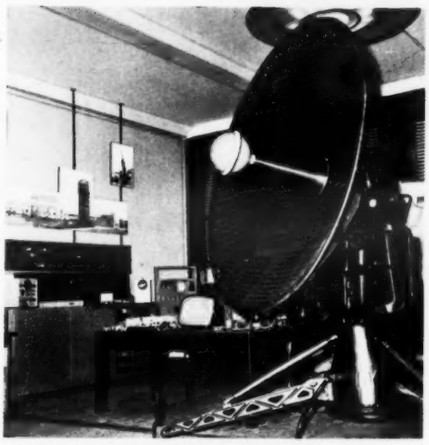


In the open the largest rocket motor in the Paris Exhibition, the Rocketdyne motor for the *Thor* IRBM, was on show. This motor was built at North American Rocketdyne Division's Canoga Park plant under the factory code number S-3. Its thrust is 160,000 lb. In countless *Thor* firings and launchings of nearly a dozen space vehicles the S-3 has proved itself as the most powerful single-chamber motor now in production in the western world.



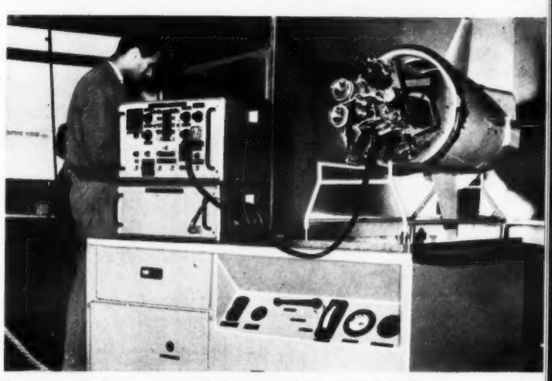
PARIS PARADE OF RECIPROCATING AND GAS TURBINE ENGINES

	MANUFACTURER AND COUNTRY	TYPE DESIGNATION	POWER CLASS	INSTALLED WEIGHT	REMARKS
PISTON ENGINES			Power in h.p.	lb.	
	Walter/Omnipol (CSR)	Minor M.332	140	224	Fitted in L-40 Meta-Sokol and Aero 145; sales by Omnipol.
		Minor M.337	210	—	Fitted in L-200 Morava; sales by Omnipol.
	Potez-Air Fouga (FRN)	Potez 4D34	260	408	E. g. in Nord 3400 army observation aircraft.
		Potez 4E	90	198	Experimentally fitted in Jodel two-seater.
	Alvis Ltd. (GBR)	Leonides Series 530	640	~860	Used in fixed-wing aircraft (e. g. Twin Pioneer).
		Leonides Series 550	625	—	For helicopter installation, e. g. Sycamore, Widgeon, Agusta-Bell.
		Leonides Major 702/1	875	1,200	For fixed-wing aircraft.
		Leonides Major 755	795	1,050	For helicopters, e. g. Westland Whirlwind.
	Meccanica Verghera Agusta (ITL)	G.A.40	42	86	For powered gliders; in production.
		G.A.70/0 and G.A.70/V	83/82	172/158	Version G.A.70/V for the Agusta 103 and 103B light helicopters.
	ENMASA, Empresa Nacional de Motores de Aviacion (SPN)	Tigre G5	150	342	Fitted in e. g. AISA I-115 and INTA HM-1 trainers.
		Alción A1	275	496	In versions for fixed-wing and rotorcraft installation.
	Lycoming (Avco Mfg. Corp.; USA)	VO-435-A1D	260	390	Represented by Fenwick S.A.; VO-435 and GO-480 also built under licence by Piaggio.
PROPELLER TURBINES			s.h.p. + lb thrust (e.h.p.)	lb.	
	Société Turboméca (FRN)	Bastan II	750+185 (935)	770	Weight including propeller. For SE.117/SE.118; MD.410/MD.415; also Beech Bastan, Super Broussard, MS.1500 Epervier.
		Astazou	420+85 (450+)	408	Weight including propeller. In MH.152; projected for Nord 1100.
	Bristol Siddeley (GBR)	Proteus 765	3,890+1,250 (4,445)	2,900	For Bristol Britannia; newest version is Proteus 770 of 4,615 e.h.p.
	The de Havilland Engine Co. (GBR)	P.1000 Gnome	1,000/1,400	555	For various new STOL types; e.g. Breguet 941.
	D. Napier & Son Ltd. (GBR)	Eland 504	3,230+700 (3,500)	1,820	E. g. in Canadair 540; modified Eland for rotorcraft in Rotodyne; also 229A version for Westminster heavy helicopter.
	Rolls-Royce Ltd. (GBR)	Dart RDa.7/2	1,910+505 (2,105)	~1,250	Special exhibits included components from a Dart which had been in length commercial operation. Power of 3,000 + h.p. is aimed at for civil Darts.
		Tyne RTy.1	4,500+1,250 (4,985)	~2,020	Later versions of 5,545 and 5,730 t.e.h.p. (military). Fitted in Vanguard, CL-44 Britannic and a future version of the Rotodyne.
	General Electric Co. (USA)	T64-GE-4	2,570	1,079	Also T64-GE-2 of 2,650 s.h.p.; for helicopters and STOL/VTOL aircraft.
	Lycoming (Avco Mfg. Corp.; USA)	T53-L-3 (LTC1F-1)	960+113 (1,005)	499	Represented by Fenwick S.A.; also in versions for helicopters and STOL/VTOL aircraft.
TURBOSHAFT ENGINES	Société Turboméca (FRN)	Artouste IIC	406	262	Produced in large numbers; in Sud-Aviation Alouette II.
		Artouste IIIB	550	408	In Alouette III.
		Turmo IIIB	750/800	560	In SE.3200 Frelon; later version of the SE.3200 will have Turmo IIIC of 1,000 1,100 h.p.
	Blackburn & General Aircraft (GBR)	A.129	800/850	~390	Later versions to deliver up to 970 s.h.p.; for helicopters. Turboprop version under consideration.
	Bristol Siddeley (GBR)	P.181	1,020+200	430	For helicopters and STOL aircraft.
	The de Havilland Engine Co. (GBR)	H.1000 Gnome	1,000	~350	Weight including reduction gear. For Agusta Z.101D helicopter; also for version of the Saunders-Roe P.531; Westland Whirlwind.
	D. Napier & Son Ltd. (GBR)	Eland 229A	2,600/2,850	1,500	Two Eland 229As in Westland Westminster.
		Gazelle NGa.3	1,450/1,800	865	In Westland Wessex and Bristol 192 helicopters.
	General Electric Co. (USA)	T58-GE-6	1,050	271	Also T58-GE-8 of 1,250 s.h.p. In helicopters, e.g. Kaman HU2K-1, Sikorsky HSS-2, S-62, Vertol V-107 and VTOL aircraft. (Fairchild M2241, Kaman 16B
Turbo-Compressors	Société Turboméca (FRN)	Palouste IV	2.5 lb./sec (41.2 psi)	198	Sud-Aviation Djinn; licence production at Blackburn & General Aircraft.
	Blackburn & General Aircraft (GBR)	Turmo 600	7.2 lb./sec 400 SHP	310	For Saunders-Roe P.531.
	Fiat (ITL)	Fiat 4700.000	600 SHP	265	For Fiat 7002 helicopter.
	Boeing Airplane Co. (USA)	T60-Bo-2	5.5 lb./sec 400 SHP	350	For helicopters; under development.
JET ENGINES			Thrust in lb.	lb.	
	Société Hispano Suiza (FRN)	R.350 Verdon	7,720	2,070	Derived from Rolls-Royce Tay; fitted in Mystère IVA.
	SNECMA (Société Nationale d'Etude et de Construction de Moteurs d'Aviation; FRN)	ATAR E.5	8,160	1,940	Atar E.3 version (7,700 lb. thrust) and E.5 (8,140 lb.) in quantity production Fitted e.g. in Vautour and Nord Griffon. Also Atar G.2 and G.3 (as E series but with reheat); thrust 9,680 lb. Atar G in Super Mystère B.2.
		ATAR 8	9,700	2,310	In Dassault Etendard IVM.
		ATAR 9	13,230	2,930	As Atar 8, but with reheat; Version Atar 9C of 14,080 lb. thrust with afterburner
	Société Turboméca (FRN)	Marboré II	880	313	In large-scale production (also under licence); in Fouga CM.170 Magister and CM.175 Zéphyr; Morane-Saulnier MS.760, etc.
		Marboré VI	1,060	337	Same installed dimensions as Marboré II.
	Bristol Siddeley (GBR)	Sapphire ASSa.7R	12,300	3,180	In Gloster Javelin FAW.8.
		Viper ASV.11	2,500	500	Built in several versions; e.g. ASV.8 of 1,750 lb. thrust for Hunting Jet Provost
		Orpheus 803	5,000	—	Orpheus licences to Italy, France, USA and India.
		Orpheus BOr.12	6,810	1,110+	Max. thrust with Bristol afterburner 8,625 lb.
		Olympus 201 (BOl.7)	17,000	~3,600	BOl.7R version thrust with reheat up to 24,000 lb.
	The de Havilland Engine Co. (GBR)	Gyron Junior DGJ.1	7,000	~1,540	Also DGJ.10 version of 7,800 + lb. thrust; in Blackburn NA.39.
	Rolls-Royce Ltd. (GBR)	Avon RA.24R	11,250	—	Thrust without reheat; thrust with reheat not known.
		Avon RA.29	10,500	~3,340	E.g. in Comet 4; later versions will deliver 11,700 lb. and 12,500 lb. thrust.
		Conway RCo.10	16,500	3,500	For Boeing 707-420 and certain versions of the Douglas DC-8; thrust to be increased to 17,500 lb. Military version in Victor B.2; RCo.15 of 18,500 lb.
		RB.108	2,010	~250	Primarily for VTOL and STOL aircraft; in Short SC.1.
	Fiat (ITL)	Fiat 4002.001	716	194	Also 4002.000 of 595 lb. thrust.
		Fiat 4032.000	6,610	~1,080	—
	Svenska Flygmotor (SVE)	RM.6 (Avon)	~13,000	—	Avon 200 built under licence, with Swedish afterburner; in e.g. Saab-35 Lansen
	General Electric Co. (USA)	J85-GE-1/3	2,000	~300	In various versions; in Northrop T-38/N-156F; McDonnell GAM-72; NAA T-39
		CJ-805-23	15,000	3,700	Civil turbofan engine; military version TF35. CJ-805-23 in Convair 600.
		CJ-805-3	10,000+	2,800	In Convair 880.
		J79-GE-1/3	15,000	3,200	In Lockheed F-104, Convair B-58, Grumman F11F-1F Super Tiger, Chance Vought Regulus II, NAA A3J and McDonnell F4H.
	Pratt & Whitney Aircraft (USA)	JT12A-1/JT12A-20 (J60)	~2,900/3,000	430	In NAA T-39, Lockheed Jetstar, McDonnell 119 and in target drones. JT12A-20 version with afterburner: 4,400/4,880 lb. thrust; weight 645 lb.
		JT8 (J52)	~7,500	—	For civil and military use; also for target drones.
		JT3C-7/C-6 (J57)	12,000/13,500	3,500/4,200	The JT3C civil models are fitted in versions of the Boeing 707 and Douglas DC-8 J57 military versions in B-52/KC-135 and Century Series fighters.
		JT3D (TF33)	17,000	—	Based on the JT3C, but with additional turbofan.
		JT4A (J75)	15,800/16,800	~4,200/5,000	Civil version fitted in Boeing 707 and Douglas DC-8; J75 military versions in F-105, F-106, etc. Military versions deliver up to 26,000 lb. thrust with reheat



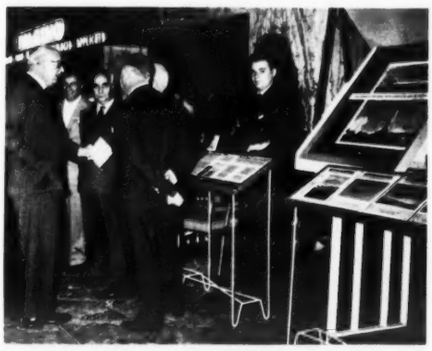
Anti-aircraft training equipment for the Italian Army.

6th International Congress on Electronics, Atomics, Television, Radio and Film, Rome



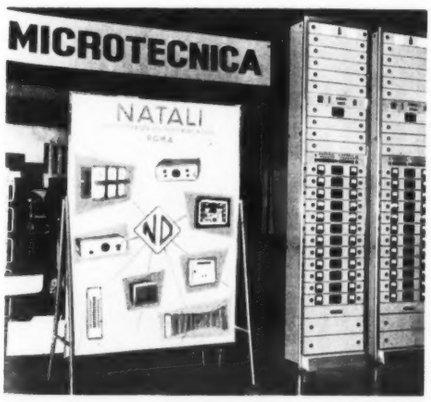
Contraves Italiana: part of the tail of an anti-aircraft missile.

The International Exhibition of Electronics, Television, Radio and Film opened its doors for the sixth time in Rome on June 15th. The now traditional show was supported by a large number of organizations and companies working in the aeronautical, telecommunications and missile fields. These included Italy's National Research Council (Consiglio Nazionale delle Ricerche), Euratom, Italy's Nuclear Research Committee (Comitata Ricerche Nucleari), Fiat-Nucleare, Britain's Atomic Energy Authority and France's Indatom. Equipment and installations were exhibited by Industrie Riunite Elettroniche Meccaniche (formed jointly by Finmeccanica and CSF), Nuova San Giorgio (equipment for naval anti-aircraft defence), Marconi Italiana (telecommunications equipment and special items for aviation), Siemens (telecommunications equipment), Duilio Natali (radio stations), FACE Standard (guidance systems for missiles), IT&T (missile equipment), Microtecnica (synchronous motors and airborne equipment), IBM (automation equipment), Olivetti (electronic automation systems), Appleby and Ireland (instruments), St. Gobin (special equipment), Telettra (radio links, multi-channel transmitter/receiver equipment), Sindel (ground and aircraft radar, telemetering equipment for missiles), Cea-Perego (telecommunications systems), Contraves Italiana (parts for surface-to-air missiles, equipment for missile air defence, fire control system Type 127A for naval anti-aircraft defence), Fabbrica Italiana Magneti Marelli (radio stations, radio links), FIVRE (radar tubes), Thompson-Houston (general electronic equipment). The exhibition was supplemented by two international congresses on atomic energy and electronics. The accompanying pictures give some idea of the exhibition, which was visited by roughly 400,000 persons.



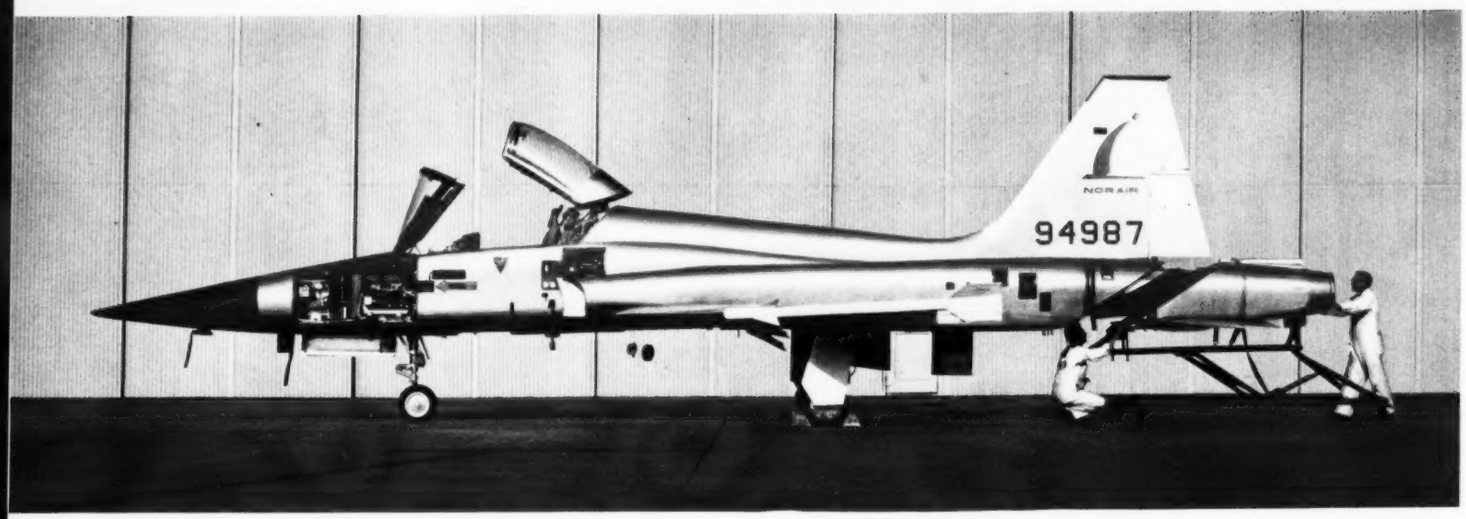
Senator Armando Angelini (left), Italian Minister of Defence, in conversation with Commendatore Dr. Giorgio Lourier, Manager of Interavia Italy (back to camera).

Società Duilio Natali showed radio stations for aeronautical use.



Warning and control systems for the air force on the FACE-Standard stand.

The United Kingdom Energy Authority's stand.



Design for Minimum Maintenance Northrop N-156F

Long before the first Northrop N-156F rolled out of the final assembly shop at the Hawthorne plant, the information released by the manufacturers stressed that this new lightweight fighter would not only be an economical buy for light budgets but would also merit consideration for its low-cost upkeep and simple maintenance. The trend towards increasingly refined aircraft designs means that not only production but also maintenance becomes increasingly costly, since the more complex airframe and equipment give rise as a rule to reduced operational reliability, which can be made good only by an increased maintenance outlay. Northrop Corporation has now tried to reverse this trend, and its N-156F design therefore merits special attention.

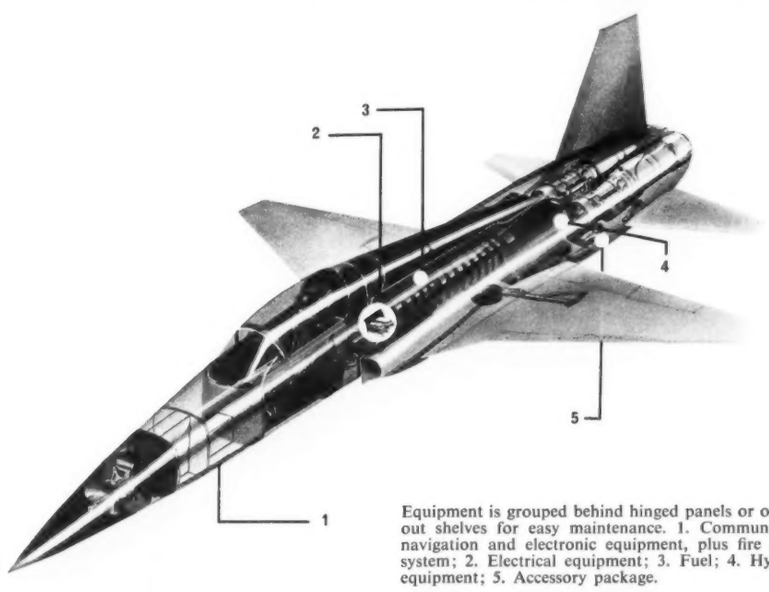
Now that the two prototypes of the T-38 sister design have made several dozen test flights at Edwards AFB, and the N-156F is also ready to take to the air shortly, *Interavia* has taken this opportunity to present an illustrated account of the design and maintenance equipment of this Mach 2 fighter.

How can a supersonic fighter, which must have complex equipment, highly developed engine and the latest in airframe manufacturing methods in order to meet increased military requirements, be kept small and light? How can above all the ground handling and maintenance of such an aircraft be simplified?

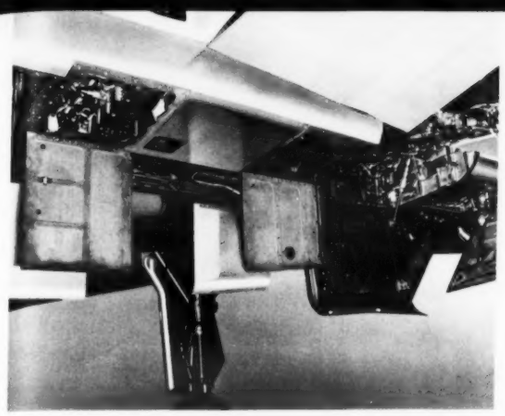
Northrop engineers discovered that less than 40 percent of the cost of a modern fighter weapons system is accounted for by the purchase price of the aircraft, spares and ground support equipment, and more than 60 percent by upkeep, i.e. maintenance, fuel, wages, training costs, etc. Their aim has therefore been to offer a multi-purpose fighter and weapons carrier which in procurement and upkeep would cost only around 65 percent as much as present-day supersonic fighters.

A reduction in maintenance man-hours can be obtained in two different ways: 1. by rational grouping and placing of the aircraft's equipment; 2. by the rational design of all individual parts requiring maintenance. The accompanying drawing illustrates how the principal equipments and accessories in the N-156F have been grouped together in easily accessible areas and on slide-out shelves. One example is the cockpit canopy, which opens backwards and forwards in two portions. It is entirely manually operated and stays locked in both the open and closed positions. There is thus no need for locking indicators or for hydraulic or electrical actuating systems. Quick-release hinges permit speedy removal and replacement by two mechanics without special tools. Some 25 percent of the fuselage surface consists of access doors of the quick-release type. Components liable to frequent replacement are located in the most accessible positions.

A particularly striking example of this maintenance concept is provided by the powerplant. The two General Electric J85 jets mounted

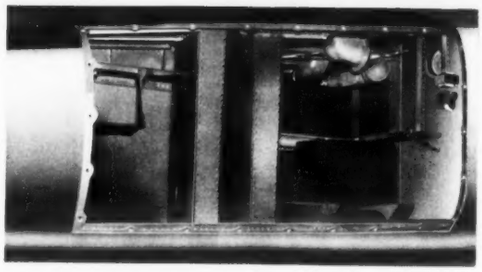


Equipment is grouped behind hinged panels or on slide-out shelves for easy maintenance. 1. Communication, navigation and electronic equipment, plus fire control system; 2. Electrical equipment; 3. Fuel; 4. Hydraulic equipment; 5. Accessory package.



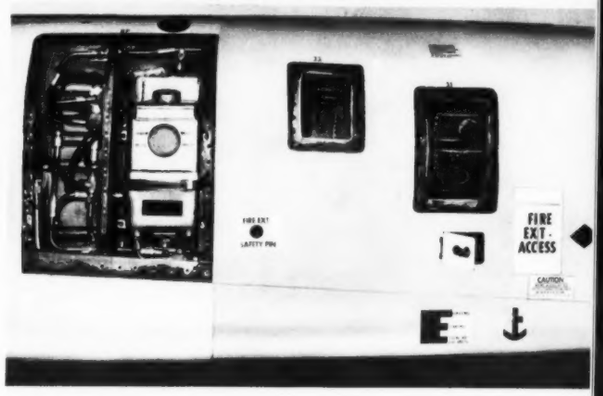
Hinged panels on the underside of the fuselage give access to vital equipment components. On right of picture are the two air brakes in extended position.

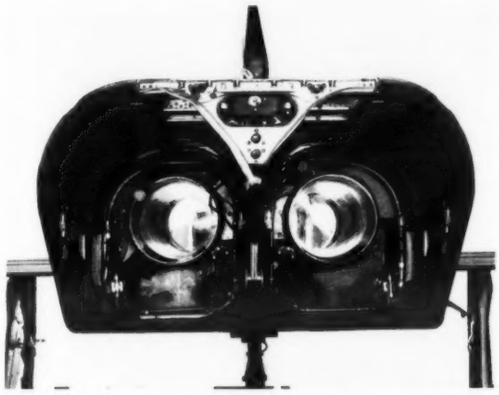
The two ventilated compartments in the nose contain radio, radar, fire control system, instruments and fuse panels, all mounted at chest height from the ground. The doors (not shown here) hinge upwards to provide shelter for mechanics working in the field.



The N-156F's nose wheel is so designed that the nose steering is automatically disengaged when the yoke of the tow bar is connected (for ground movements).

Hydraulic lines and hydraulic reservoir (left), the engine compressor face (centre) and ground hydraulic maintenance centre can be inspected by opening these doors near the fuselage rear.

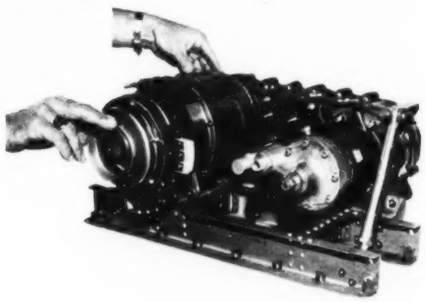


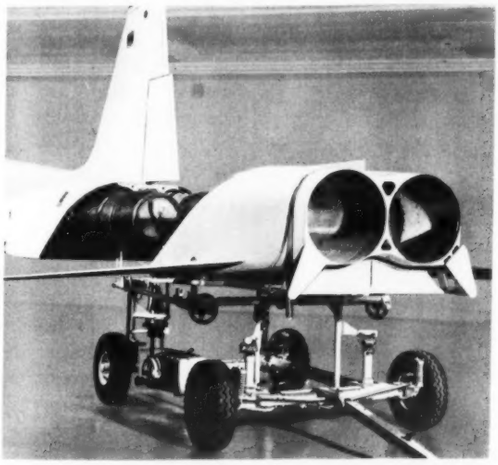


View through the empty engine bay and the air ducts to the air intakes. Rails for engine removal can be seen in the roof of the bay.

The rocket-powered ejection seat uses only one safety pin, installed in the armrest; this pin is readily removed by the pilot before take-off. This system prevents accidents to maintenance personnel or crew due to failure to install or remove multiple safety pins.

The accessory package contains a hydraulic pump and a generator assembled on a flat two-speed gearbox (rear). It is mounted on the airframe and connected to the engine through a flexible shaft (flange in the centre of the gearbox casing).

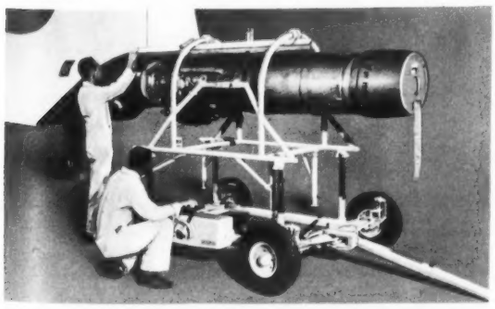


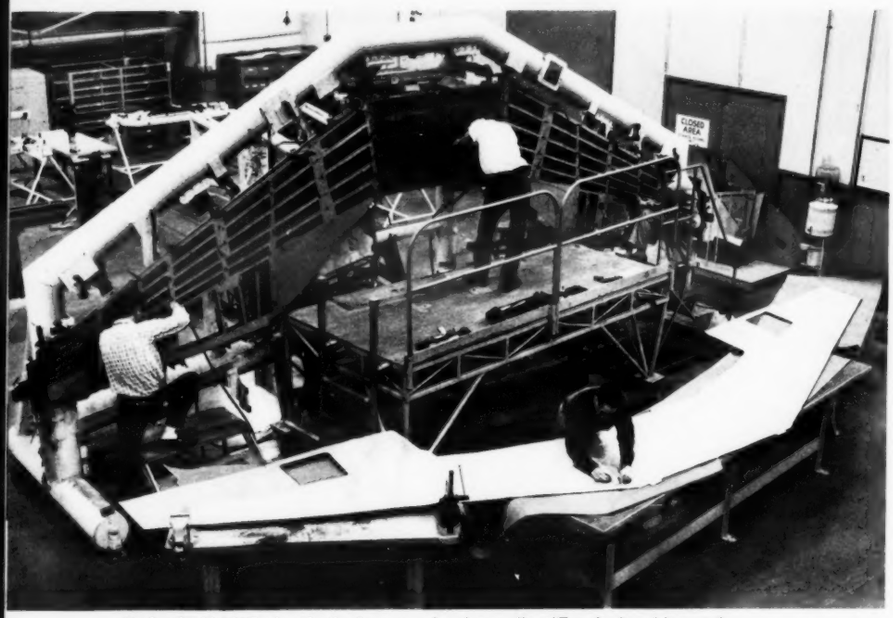


An easily handled adjustable trailer is used to support the fuselage rear (complete with horizontal tailplane) after it has been disconnected to allow removal of the engines.

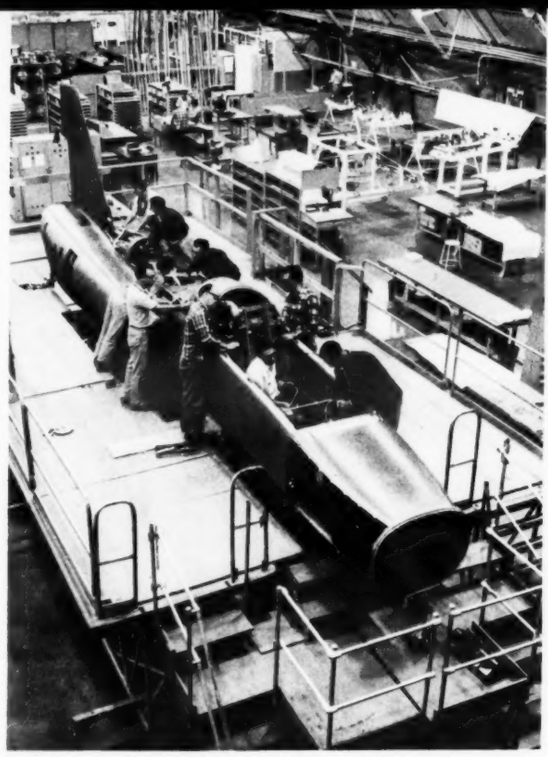
This inspection and maintenance trailer is equipped to enable all major work to be carried out on the engine. It has supporting legs to enable the framework to be lowered to the ground. The bellmouth smooths the inlet air flow for engine run-ups.

Next the two jets (including afterburners) are pushed backwards along the guide rails and suspended in this special trailer.





Jig for the N-156F wing. In the foreground an integrally stiffened wing skin panel.



Assembling the fuselage of the first N-156F prototype.

side by side in the rear fuselage can be laid bare by removing the fuselage rear complete with tailplane. Rails in the engine bays above the two J85s make the use of winches or cranes unnecessary. The small engines (weighing only 500 lb. each) are removed backwards from the airframe, placed on easily handled maintenance trailers with low-pressure tyres, and moved away for inspection under canvas. In the meantime the fuselage rear rests on a special trailer. Northrop states that less than 10 man-hours are required to ready both engines for installation on the test stand.

Another time-saving design feature: the AC generator and hydraulic pump are not mounted directly on the engine, but are located on the two-speed gearbox mounted on the airframe and connected to the engine through a drive shaft. This method eliminates the danger of fire from leaking hydraulic lines and also prevents the possibility of errors in wiring during engine removal and re-installation.

An extensive analysis of all possible fuel systems resulted in the following simple and reliable arrangement: two fuel tanks (one per engine) in the centre of the fuselage, to eliminate the problems of icing and fuel transfer associated with wing tanks; one AC-powered boost pump in each tank; only three fuel valves; manual controls for ground refuelling. Should the boost pumps fail, sufficient pressure head exists within the tanks to continue flight. A cross-feed system enables each engine to be switched to either of the tanks (for example, for single-engine flight).

Although many details of the N-156F's electronic equipment are still secret, the pictures reveal that the whole electronics are housed in the conical space between the fuselage nose and the pilot. Radio navigation equipment, radar, fire control system and fuse panels are virtually all installed at chest-height from ground level and are reached via large doors which open upwards to provide shelter from the weather. Built-in test features in equipment such as the stability augmentation and electrical power systems enable malfunctioning to be located without removing any components.

The electrical system consists in essentials of two 8 KVA variable frequency brushless alternators, a long-life nickel-cadmium battery and a number of inverters. Engines can be started on the ground by using the battery, assisted by a static inverter for constant frequency power. Once the engines start, DC power is supplied by a single rectifier when either alternator is operating. The nickel-cadmium battery also supplies power in the event of engine stoppage in the air. Constant frequency power for operation of oil pressure, fuel flow, engine ignition and fuel quantity gauges is supplied by the static inverter. Two independent 3,000 p.s.i. hydraulic systems, supplied from air-pressurized reservoirs, power the surface controls, landing gear and doors, speed brake, nose wheel steering and stability augmenter systems. The undercarriage braking system is independent of the main hydraulic system and uses self-energizing hydraulic brakes, similar to the multiple disc type used on some automobiles.

The accompanying pictures show other characteristic features of the N-156F's structure and give some idea of its production. As, apart from the fuselage forward section, the lightweight fighter is 80 percent identical with the T-38 *Talon* two-seat trainer and most of the components are interchangeable, the tooling installed for the trainer (quantity production of which is expected to begin shortly for the USAF) can also be used for the fighter.

The first prototype of the N-156F "Freedom Fighter" after roll-out on May 30th, 1959. Two Philco *Sidewinder* air-to-air missiles are mounted at the wing tips.

CLIMB OUT...

... To operate economically, turbo-prop and turbo-jet aircraft must be able to take-off without delay and climb uninterruptedly to their cruising altitude.
This requires the provision of sufficient laterally separated climb paths from the airport to the points at which the cruising altitude is reached.
The present use of vertical and longitudinal (time) separation, is too restrictive for these operations and is mainly responsible for delays at take-off as aircraft have to be cleared through altitudes and on tracks occupied by other aircraft.
The use of a navigation system providing accurate area coverage facilities, and hence a sufficient number of laterally separated climb out tracks, can go far toward eliminating both delays on the ground and uneconomical stepped climbs to en route altitudes after take-off.
En route and descending too, the costly navigation errors and delays, brought about by the use of out-moded and inflexible navaids, can only be eliminated when all aircraft are able to fly discrete tracks easily and accurately.

THE DECCA NAVIGATOR

THE ONLY NAVIGATION SYSTEM CAPABLE OF MEETING THE DEMANDS OF THE JET AGE

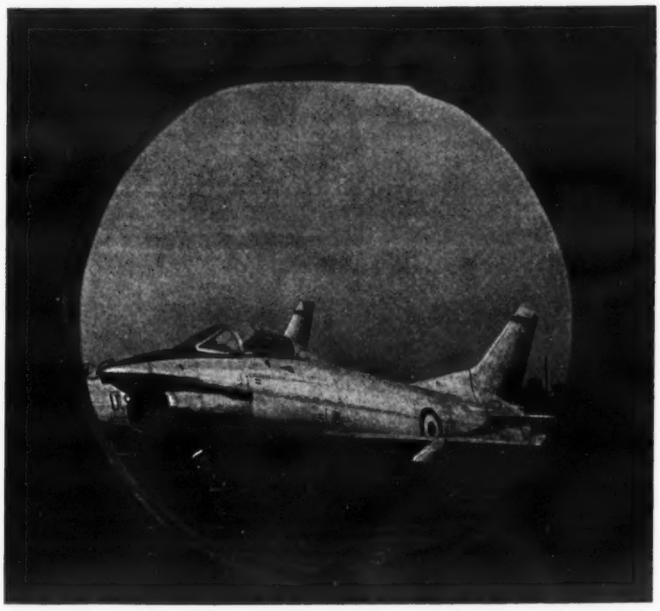
The Decca Navigator Company Limited London

THE NEW AIRCRAFT FOR THE FIFTIETH ANNIVERSARY OF FLYING IN ITALY FIAT

FIAT G 91 T

Bristol Orpheus 80302

The jet trainer, with characteristics and performance similar to those of the lightweight strike fighter version, is an aircraft especially developed for advanced training up to supersonic speeds. Meets all the requirements of the latest NATO standards and ABC agreements.

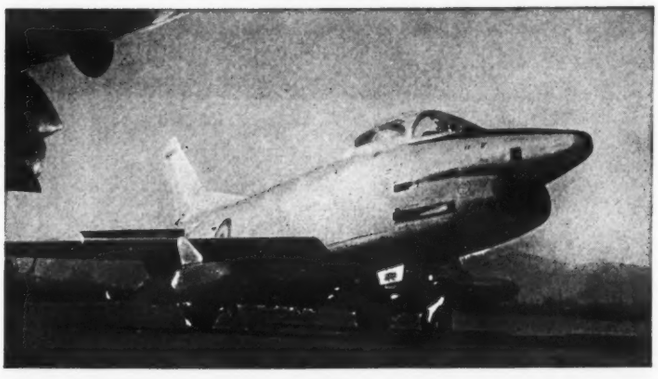


FIAT G 91

Bristol Orpheus 80302

The light strike fighter, winner of the NATO contest. Basic advantages :

— ability to operate from a small space on semi-prepared strips or grass runways.
— small in size, light in weight, easy and comfortable to fly, low unit and operating cost.
— versatility and maximum defensive and offensive efficiency with its basic and auxiliary weapons.



FIAT G 91 R

Bristol Orpheus 80303

Photographic version of the light strike fighter. It is capable of performing day missions at high speed and low altitude, taking photographs forwards, backwards and to right and left simultaneously, or vertical photographs.

FIAT - DIVISIONE AVIAZIONE - Corso Giovanni Agnelli, 200 - TORINO

missile
guidance
THOMSON CFTH HOUSTON
COMPAGNIE FRANÇAISE THOMSON-HOUSTON - GROUPE ÉLECTRONIQUE - 173, BD. HAUSSMANN, PARIS-8e

This tube was designed and produced by CSF

FOR AIR TRAFFIC CONTROL

The TMA 403 electronic memory tube has transformed radar operations :

by **converting** the fainter radar image into a brilliant television image, which controllers can more easily observe in daylight ;

by **retaining** the image showing the aircraft's route for several minutes, at the operator's discretion ;

by making it possible to **superimpose** on the image various service symbols, aircraft identifications, geographical features . . .

by making it possible to **transmit** the complete radar picture, via coaxial cable or long-range radio links, like a normal television programme.

Civil and military applications.

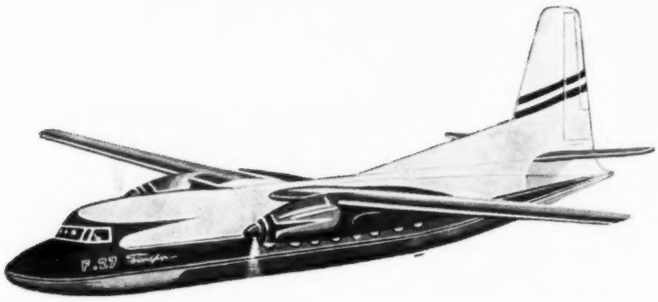
Compagnie générale de télégraphie Sans Fil

CSF

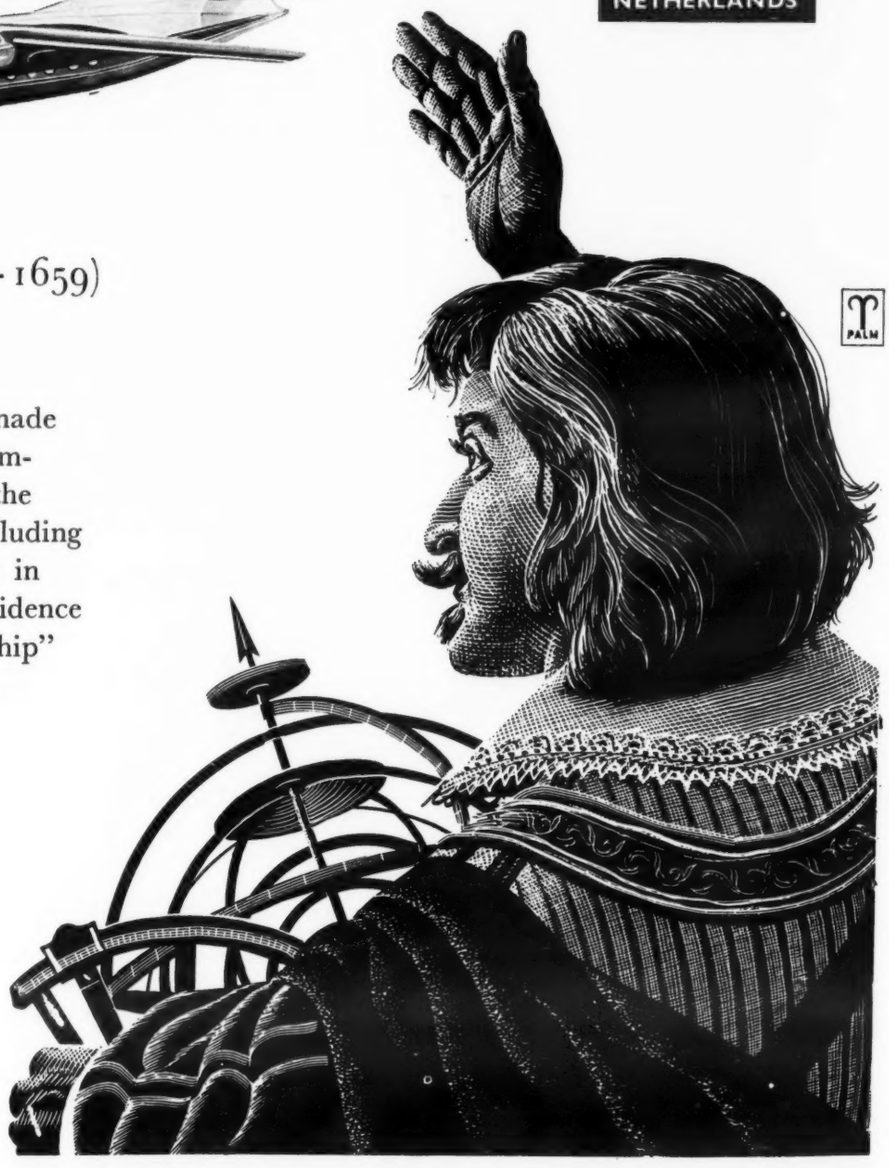
Capital : 3,998,750,000 francs

Head Office : 79, Bd Haussmann - Paris 8e - ANJ. 84-60

PIONEERING: TRADITIONALLY DUTCH



Fokker
NETHERLANDS



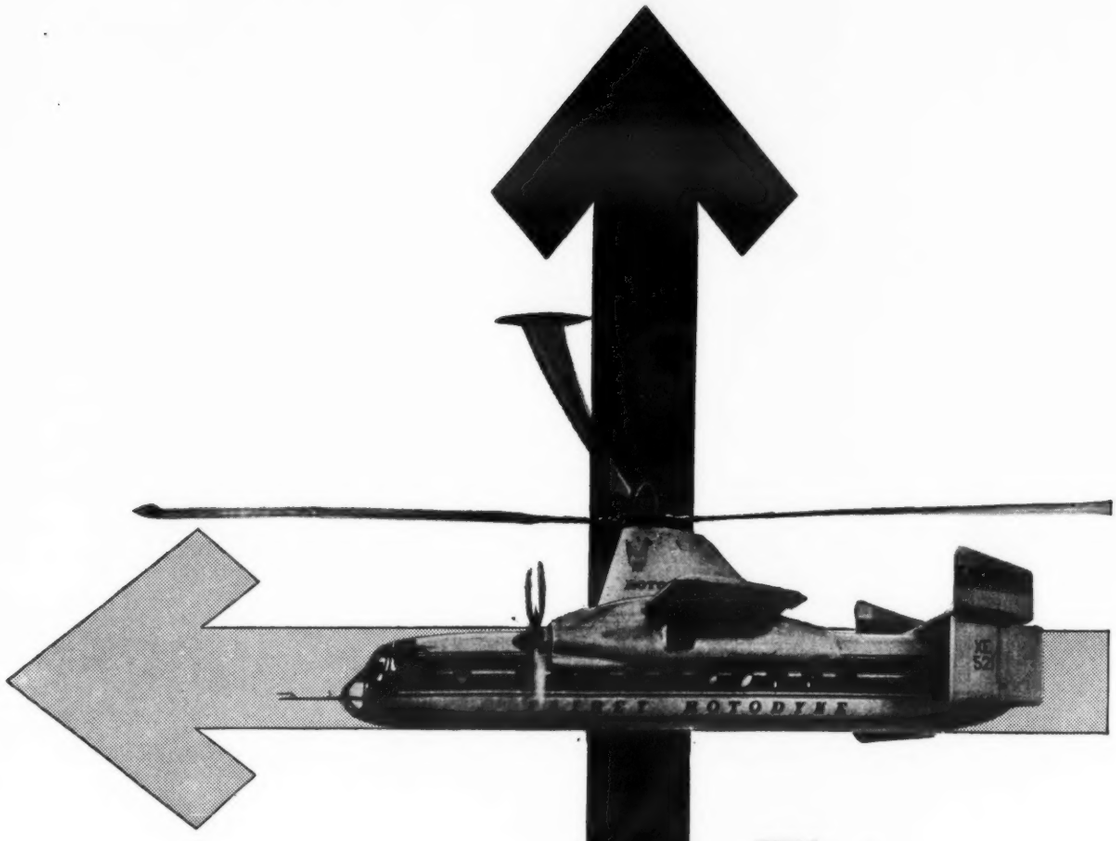
Abel Tasman (1603 - 1659)

The pioneering spirit that made Abel Tasman the first circumnavigator of Australia and the discoverer of many lands (including Tasmania) is still fully alive in the Netherlands. Modern evidence is the Fokker F. 27 "Friendship" a superb, economic prop-jet airliner with Rolls-Royce "Dart" engines.

The Fokker F. 27 is also built under licence by Fairchild Engine and Airplane Corporation U.S.A.

FOKKER launches

world-encompassing *Friendship*



The first vertical take-off airliner

LOOK FORWARD TO

ROTODYNE

TRAVEL

FAIREY AVIATION LIMITED · HAYES · MIDDLESEX

(A subsidiary of The Fairey Company Limited)

RAPID Mobility

with the STOL Caribou

The Caribou cabin will accommodate 32 troops.

•

The aircraft can take off with this impressive load in a distance of 530 feet. *(161.5 m.)*

•

It can move these men from place to place at a speed of 156 knots. *(289 kph.)*

•

Large rear loading door permits loading (or deplaning) 32 troops in 40 seconds.

•

A Caribou has loaded and unloaded 3 tons of cargo in 5 minutes total turn-around time. *(2722 kg.)*

•

In the new concept of lightning war, the Caribou's ability to move big loads in and out of small improvised landing strips quickly means greater concentration of our land forces through the use of RAPID MOBILITY.

DE HAVILLAND AIRCRAFT OF CANADA
DOWNSVIEW *ONTARIO*

Only the VANGUARD has this low-cost story

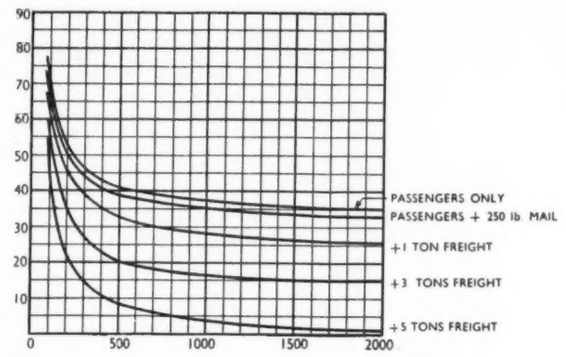
THE CONCLUSIONS to be drawn from this simple graph are among the most significant ever put to airline operators. It shows at a glance that the Vickers Vanguard will break even on total costs (indirect costs are taken as 100 per cent of direct) with passenger loads no higher than those actually carried by Viscounts today.

With three tons of freight the passenger break even requirement can be as low as 21 people falling to only 8 passengers when five tons of freight is carried for 500 miles. The Vanguard is a profitable aircraft on today's payloads yet it has room for the inevitable expansion of traffic which, even at a modest progress, makes the Vanguard the biggest potential money earner ever built.

In addition to its outstanding economy, the Vanguard is fully competitive in speed (425 m.p.h. cruise), and its turbo-prop flexibility will enable it to maintain schedules as good as any, while allowing for realistic traffic conditions.

BREAK EVEN NEED–CURRENT TOURIST RATE

No of PASSENGERS (*European Economy Class Capacity—139*)



BREAK EVEN NEED — PASSENGERS ONLY

500 MILE SECTOR

1 CLASS	31 PASSENGERS
TOURIST CLASS	39 PASSENGERS
*ECONOMY CLASS	49 PASSENGERS

*(20% Reduction of tourist)

Based on current European costs and revenues.

Of *all* the airliners only the Vanguard has *all* these features

425 m.p.h. cruising • Freight capacity 10 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience ... **And it is 'Viscount' quiet.**

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• *The airliner with the biggest profit potential ever offered to the operator*

VICKERS - ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY ENGLAND

The Cargomaster can carry almost any piece of military equipment—assembled and ready for action.

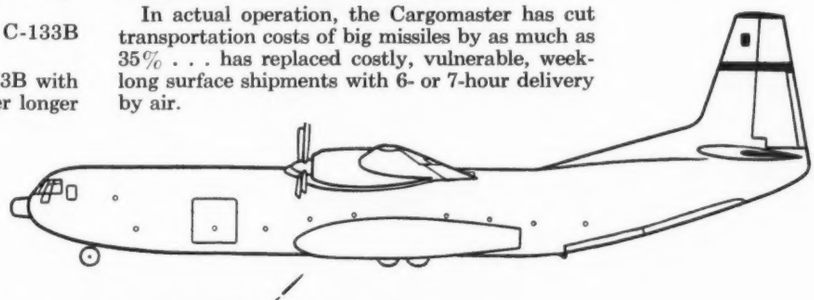
Douglas Cargomaster gives new mobility to NATO defenses

The giant Royal Air Force *Thor*, America's *Jupiter* and *Atlas*, England's *Black Knight* or any missile in the NATO arsenal can now be airlifted, fully assembled, to launching pads within range of any military target in the world.

The lifter—Douglas Aircraft's new C-133B Cargomaster.

Douglas designed the turbo-prop C-133B with the ability to carry greater payloads over longer distances than any other airplane. It can fly a 25-ton cargo *non-stop* from Ankara to Calcutta . . . from Sydney to Hong Kong . . . from Paris to Dakar at better than 320 miles per hour!

In actual operation, the Cargomaster has cut transportation costs of big missiles by as much as 35% . . . has replaced costly, vulnerable, week-long surface shipments with 6- or 7-hour delivery by air.



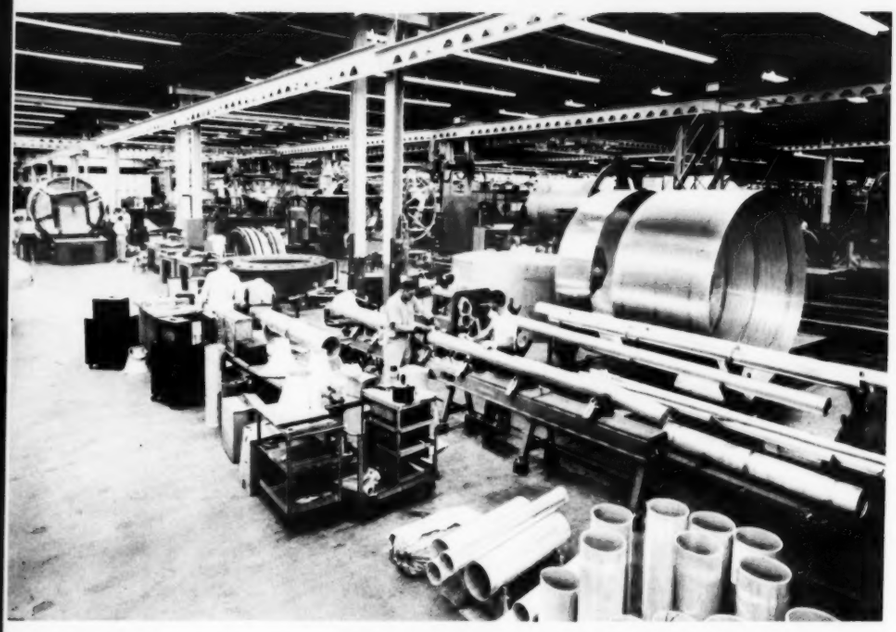
C-133B Cargomaster . . . can be loaded in as little as 10 minutes, utilizing a Douglas-developed conveyor and tie-down system. Maximum payload—90,000 pounds. Maximum speed—359 miles per hour!

Depend on **DOUGLAS**

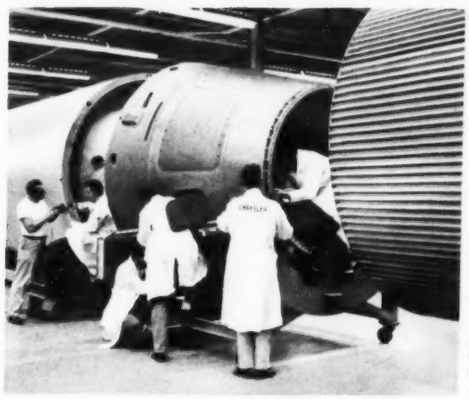
first in Aviation

Chrysler Produces IRBMs

The Jupiter Rolls



Assembling the cylindrical shell sections. The pipes in the foreground are part of the propellant feed system and—contrary to the practice in the *Thor* and *Atlas*—are all housed inside the missile.



Matching the conical section to the cylindrical tank section. Right, the corrugated casing of the thrust unit of a second missile.

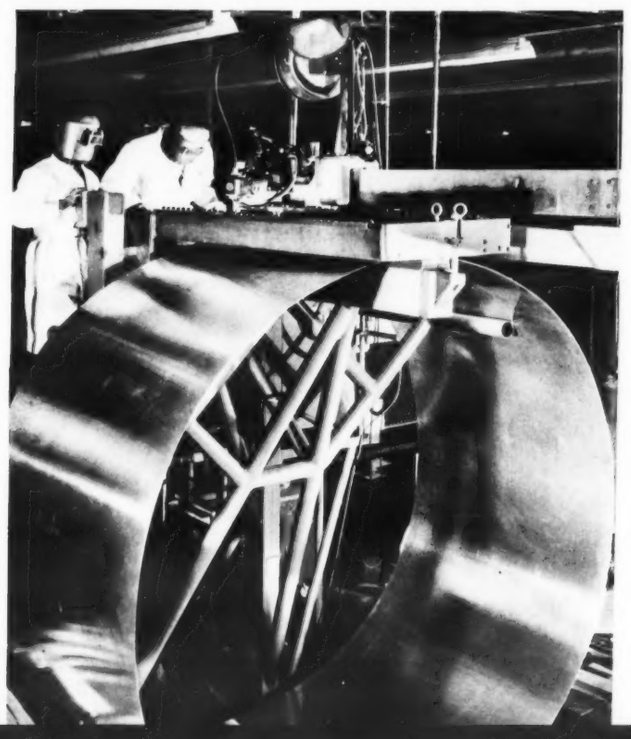
The Chrysler Corporation of Detroit was the first American company to begin quantity production of a large ballistic missile, the *Redstone* short-range tactical weapon. In October 1952 the Corporation began development work on this missile in cooperation with the U.S. Army Redstone Arsenal, and at the end of 1955 received a substantial production contract.

At about the same time Chrysler began work on rockets with a range of about 1,500 miles and was awarded a U.S. Navy contract to investigate a weapons system of this kind for ship and shore operation. This research work was followed up in June 1956 by an important development contract—which led, after repeated switches in U.S. military thinking, to today's *Jupiter* IRBM—and finally, in November 1957, by a comprehensive production contract for both the rockets and their ground support equipment.

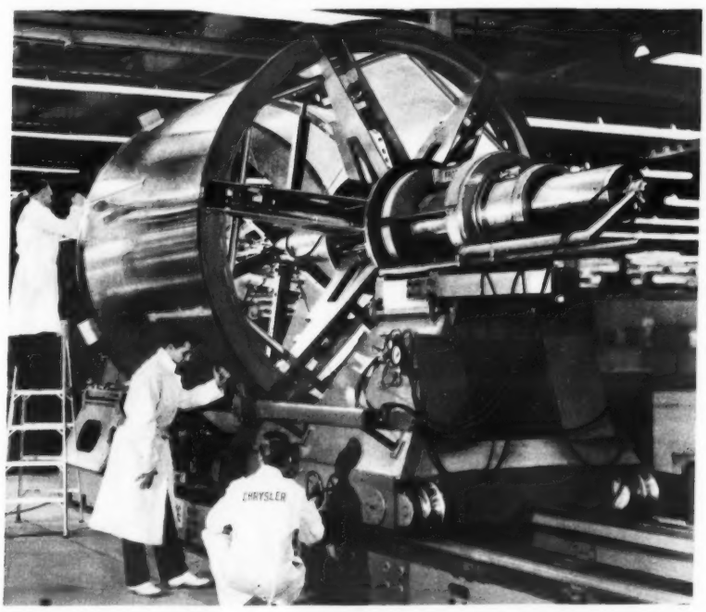
Whereas Chrysler began work on the *Redstone* with a technical staff of 26 engineers and scientists acting as consultants to the U.S. Army's rocket team, the present Chrysler Missile Division employs well over 10,000 personnel, most of whom work at the government-owned Michigan Ordnance Missile Plant in Sterling Township, near Detroit, where dozens of *Jupiters* have already been produced. More than a thousand of the Corporation's employees work at the Army's Huntsville, Alabama, rocket centre, at the White Sands, New Mexico, rocket proving ground and at Cape Canaveral.

The sub-contracting procedure already employed with success by Chrysler in automobile manufacture was carried over into *Jupiter* production. Sperry Rand's Ford Instrument Division (Long Island City) supplies the guidance and control system, North American's Rocketdyne Division

Automatic welding equipment is used to join the skin sheets into cylindrical segments. These simultaneously form the propellant tank walls.



The individual cylinder segments are welded together by the automatic welding equipment seen here. The base of the rotating "spider" is mounted on rails and can therefore be moved along as the shell grows in length.



off the Assembly Line

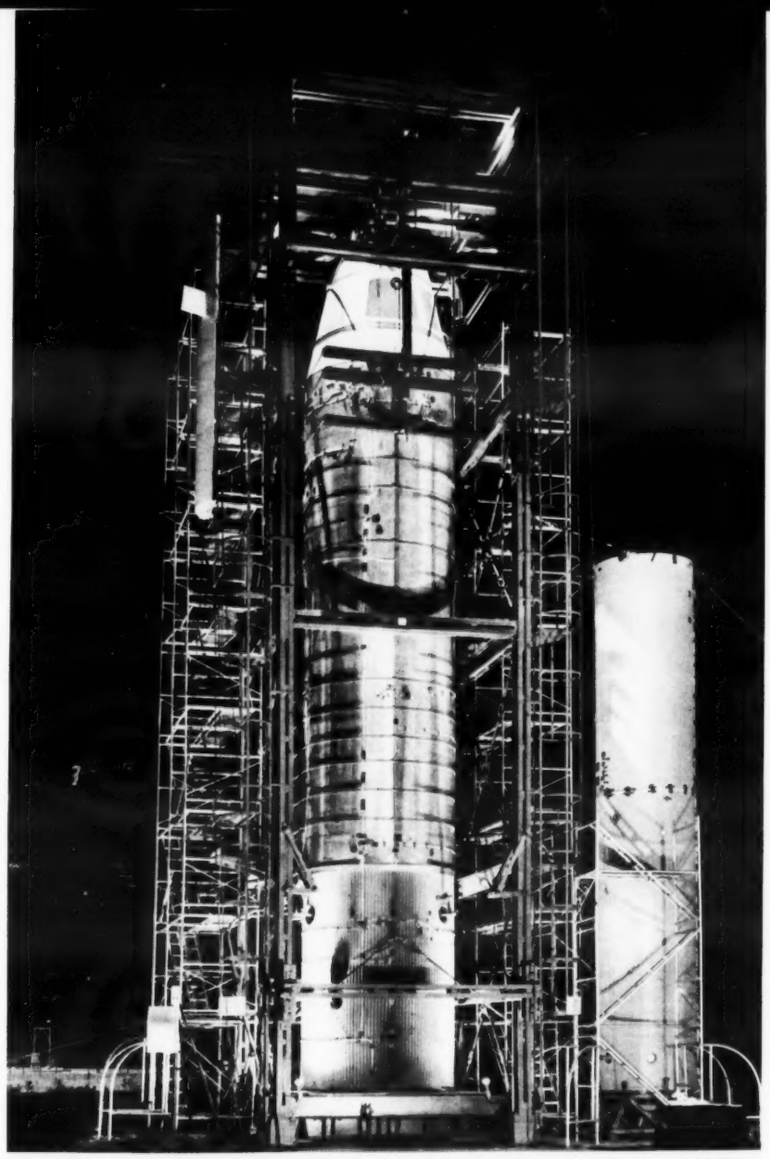
(Canoga Park) the motor and Goodyear Aircraft Division (Akron) the nose cone. A total of 2,500 contractors, of which 75 percent are small business firms, share in Chrysler's guided weapon programme.

Although large rockets cannot be produced in the same quantities as automobiles, they are manufactured and put together by the assembly line method, where special emphasis is laid on the continuous testing of all components (an automobile can have up to 16,000 parts, in the case of the *Jupiter* the number is around 300,000).

The construction of these giant rockets required dozens of specialized machine tools and equipments, including a vertical fixture with several floors for the assembly of the airframe rear, an expanding rotary "spider" for welding the cylindrical sections together, and precision fixtures with hydraulic rotation systems which revolve the airframe segments as they are welded together. This procedure is necessary for checking the alignment of the motor axis with that of the airframe by means of collimators so as to avoid asymmetrical thrusts on launching.

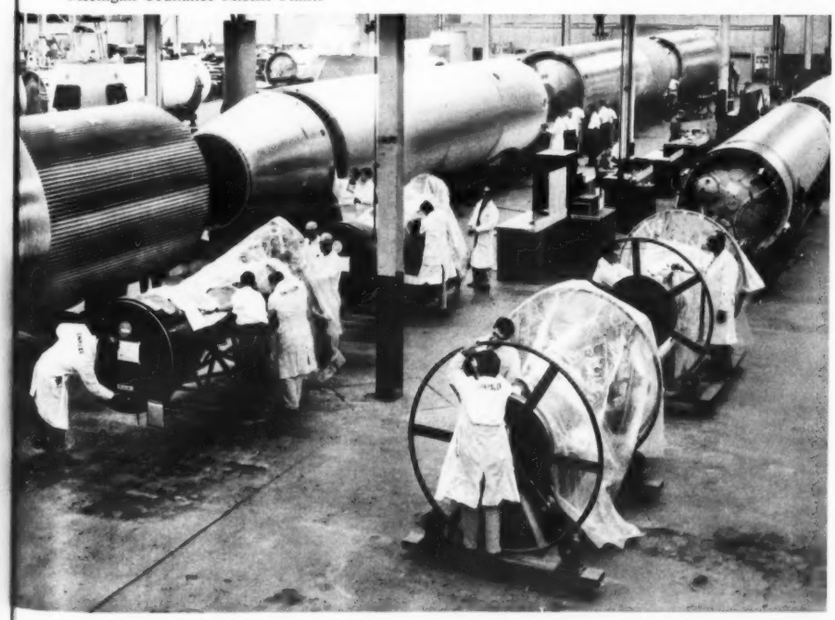
Essential items in the *Jupiter* production test equipment are a portable X-ray unit for inspecting welded seams, a "vacuum box" for testing certain operational functions of the missile in outer space, and an electronic system to determine the missile's centre of gravity.

The production of giant rockets, which can be tested only on the ground before facing their supreme ordeal, but must carry out their one and only mission with one hundred percent reliability, is a science in itself. When the completed IRBM's are sent out from the plant to training or operational units each weapon is accompanied by 300 volumes of operating instructions with a total of 22,000 pages.



Static and dynamic testing of the completed *Jupiter* begins by placing the missile body in a rig and filling it with water. Pressure and aerodynamic bending loads are then applied to simulate the air and acceleration forces encountered during ascent through the atmosphere. More than 200 channels record the behaviour of the shell walls.

Airframe sections of the *Jupiter* IRBM (left) and the tactical *Redstone* (right), together with their respective Rocketdyne rocket engines, are lined up side by side, ready for delivery, at the U.S. Army Michigan Ordnance Missile Plant.



Technical Data on the SM-78 Jupiter IRBM

Length 59 ft. Launching weight 105,000 lb.
Diameter 105 in. Design range 1,500 nautical miles.

Powerplant: Rocketdyne S-3 single-chamber gimballed rocket motor, similar to the LR-79 rocket motor on the *Thor* IRBM; static ground thrust 150,000–160,000 lb.

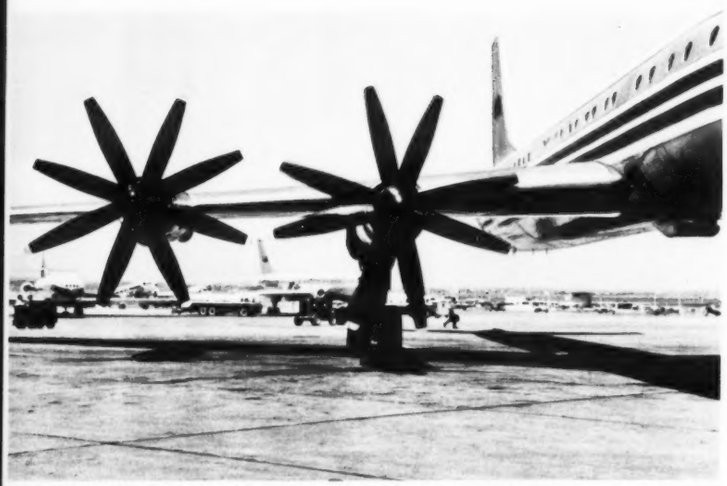
Propellants: RP-1 (kerosene) and liquid oxygen

Guidance system: the Delta Minimum Inertial Guidance System was developed by the Army Ballistic Missile Agency and is entirely self-contained. The missile follows a pre-programmed trajectory recorded on magnetic tape and containing the precise target coordinates. Any deviation from the programmed trajectory during climb is measured by gyros and corrected by a computer carried in the missile. The *Jupiter* is controlled by deflecting the combustion chambers and the exhaust gas outlet from the turbo-pump generator under the motor. Vernier rockets are not used, since excellent results have been obtained on all *Jupiter* firings to date by using the exhaust gases from the turbo-pump generator for roll control.

Nose cone: Unlike other USAF long-range weapons the *Jupiter* has a nose of marked conical shape coated with layers of laminated plastic. It is not in the form of a heat sink like the flattened heads of the *Atlas*, the *Thor* and the *Titan*, but is so designed that the plastic layers melt uniformly on re-entry (ablation cone). The metal underneath must suffer no damage, and the aerodynamic shape (and hence the re-entry path) must be maintained. After burnout of the main rocket motor the entire nose cone separates from the rest of the missile and is accelerated by a small governable solid propellant rocket to the exact initial speed required. Here the nuclear warhead (roughly 1 megaton explosive force) is detached from the nose cone and precedes it on its flight.

Long-Range Services with 170 Passengers

Tupolev Tu-114 Rossiya



The *Rossiya's* eight-blade contra-rotating propellers have a diameter of roughly 21 ft. and must each convert 12,000 s.h.p. into several tons of thrust on take-off.

The Russians' new seven-year plan calls not only for the enlargement of almost 100 airports in all parts of the Soviet Union and the extension of Aeroflot's route network to Western Europe, but also for a radical renewal of the national flag carrier's fleet of medium and long-range aircraft. It is already several years since the Western public was made acquainted with the new Tupolev Tu-104A twin-jet standard model for 70 passengers (and more recently with the improved 100-seat Tu-104B version). Now two more new designs from the Soviet aircraft industry have made their debut in Western cities: the Ilyushin 11-18 turboprop airliner for 75 passengers (cf. *Interavia* No. 6, 1959) and the Tupolev Tu-114 *Rossiya*, with accommodation for 120 to 220 passengers. The *Rossiya* is the biggest turboprop aircraft in the world, and is powered by four 12,000 s.h.p. engines.

The development of a long-range transport weighing more than 150 tons was first announced by the Russians in 1956, and the first Tu-114 was completed in August 1957. Yet when this giant was shown in public in Paris and New York it seemed almost too big to be true. Span is 177 ft, length more than 164 ft, and tail height above ground nearly 50 ft. Maximum gross weight is given as nearly 400,000 lb, and maximum landing weight as 275,000 lb. It comes as no surprise to learn that this colossus can carry a payload of nearly 40,000 lb over ranges of up to 3,000 miles and that even ranges of around 5,000 miles can still be covered with a respectable payload, as the recent non-stop Moscow-New York flight proved.

Wing, undercarriage and tail unit have unmistakably been derived from the Tupolev heavy turboprop bomber known under the NATO code name *Bear*. Nevertheless it is noteworthy that development took only 18 months, according to statements by Andrei N. Tupolev himself. The most striking achievement, however, the development of the Kuznetsov NK-12N propeller turbines weighing half a ton each, complete with contra-rotating propellers roughly 21 ft.

In the Tu-114's restaurant: vodka, caviar... and plush seats.

Inside one of the two roomy galleys. Each is in the charge of a cook, and together must provide food and drink for 170 to 220 guests during several hours.

Chief Pilot A. Yakimov at the controls of the *Rossiya* prototype during a test flight.

in diameter and reduction gear, was completed several years before (cf. *Interavia* No. 4, 1957). The same engines have been used since 1955 in the *Bear* turboprop bomber. For airline use, however, they are reported to be slightly derated. Nevertheless the *Rossiya* operates at altitudes between 32,800 and 36,000 ft. at cruising speeds of 380 to 430 knots, thanks not least to the engines, high compression ratio (13:1 at 36,000 ft) and hence their good altitude performance.

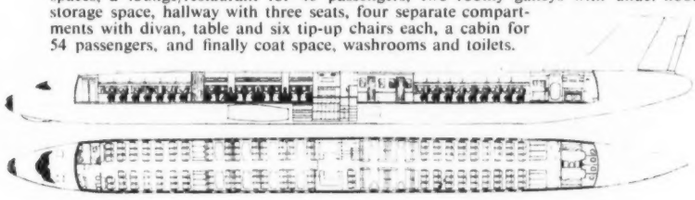
No official data are available for the *Rossiya's* take-off and landing distance, though figures of 9,350 ft. and 5,900 ft. respectively have been mentioned unofficially. Demonstrations of the aircraft in Paris seem to confirm these reports. In any case the take-off and landing distances would not appear to exceed those of modern long-range jet transports, so that the Russian turboprop monster could operate from all the major jet airports.

The Tu-114 began route proving on the Moscow-Khabarovsk stage a few months ago and covered the more than 4,000 miles between the Soviet capital and Eastern Russia without intermediate landing in eight hours and at an average speed of 430 knots. On the scheduled services shortly to be opened on this route, however, the *Rossiya* will call at Omsk and Irkutsk. The Tu-114s for use on these regular services will initially have cabin accommodation for 170 passengers, as shown in the cabin plan below. Later the projected 220-seat version will probably be operated on short high-density stages.

During his recent visit to New York, Andrei Tupolev announced that more than a dozen Tu-114s have already been completed and that the aircraft is now in full-scale production.

As the *Rossiya* – unlike the *Bear* bomber – is designed with low-set wing, the huge propellers necessitate an exceptionally long nose-wheel unit, whose welded steel tube fork is roughly 12.5 ft. long. The housing for the radar can be seen underneath the fuselage nose.

A Russian trade paper published this section drawing of the standard 170-passenger fuselage. The cabin plan shows, from front to rear: toilets, a cabin for 41 passengers, coat spaces, a lounge/restaurant for 48 passengers, two roomy galleys with under-floor storage space, hallway with three seats, four separate compartments with divan, table and six tip-up chairs each, a cabin for 54 passengers, and finally coat space, washrooms and toilets.



The mobile aircraft stairs at Le Bourget Airport are not high enough for the *Rossiya*, and Russian guests climb down onto Parisian soil via emergency steps lowered from inside the aircraft.

The tail unit is similar to that in all new Tupolev designs, but its tip reaches almost 50 ft. above ground level.

The Tu-114 at Le Bourget, closely besieged by admirers and critics. The latter disapproved of the gigantic dimensions and certain details of the undercarriage and engine nacelles.

What's in the Air?

Extracts from Interavia Air Letter, *daily international news digest, in English, French and German. All rights reserved.*

● **France's Sud-Aviation** has published data on the SE.117 *Voltigeur* and SE.118 *Diplomate* models. The SE.117 is a general purpose military aircraft designed primarily for ground support, communications services and reconnaissance, pilot and navigator training, etc. In these roles it is, of course, a rival to the Dassault MD.410 *Spirale*.

A wide variety of military loads can be carried, to suit different missions: rapidly removable container beneath the fuselage with two DEFA Type 552 cannon, calibre 30 mm; 250 rounds. For external loads six suspension devices are fitted on the wing underside. The powerplant for the SE.117 comprises two Turboméca *Bastan* propeller turbines of 750 s.h.p. each.

Characteristics and performance: span 58.95 ft; length 40.28 ft; wing area 448.85 sq.ft; equipped weight 9,260 lb; gross weight 12,420 lb without external loads, 14,370 lb with external loads. Take-off run 660 to 950 ft; landing run 660 ft; max. crusing speed 245 knots.

The SE.118 *Diplomate* is basically a direct development of the SE.117, and 67 percent of the components are identical in the two aircraft. The *Diplomate* is also designed for a variety of civil and military roles, in particular the following: small transport (eight to twelve passengers plus crew of two); business aircraft for four to six passengers; military transport for up to 20 troops. It can also be used for ambulance duties and touring purposes. The SE.118 uses the same *Bastan* turboprops as the SE.117. Dimensions, weights and performance, however, differ: span 58.95 ft; length 44.29 ft; wing area 450.7 sq.ft; equipped weight 9,920 lb, and max. gross weight 15,350 lb. Take-off run 885 ft; take-off distance to clear a 50 ft. obstruction 1,210 ft.; landing run 790 ft.; service ceiling 31,660 ft. on two engines, 17,060 ft. on one engine; average cruising speed 277 knots; range 1,080 nautical miles.

● **Ashvini TS-2** is the designation of a new two-seat glider trainer designed and built by the Technical Centre of the Indian Civil Aviation Department. The glider is to replace the out-dated training equipment still in service in India. Span 58 ft., length 27 ft. 4 in., wing area 210 sq. ft., aspect ratio 16, empty weight 700 lb., gross weight 1,102 lb., stalling speed 30 knots, minimum rate of descent 2.7 f.p.s. at 31 knots, best glide ratio 23 at 41.7 knots, max. permissible speed in dive 120 knots.

● **Bell Helicopter Corporation** reports the completion of feasibility studies for a giant nuclear-powered helicopter, and plans to continue its investigation of specific powerplant and rotor designs. The helicopter could be 300 ft. in length, with a gross weight of 500,000 lb. and a cruising speed of more than 200 m.p.h. Bell emphasizes, however, that this work has been carried out purely for study purposes and that there is no present intention of building a nuclear helicopter.

● **A.V. Roe** has produced a project, Avro 750, for a 65-80 seat *Viscount* replacement with two rear-mounted RB.141/4 engines of 15,000 lb. thrust each. Span 81 ft. 3 in., length 97 ft., cruising speed 500 knots at 25,000 ft., empty weight 38,580 lb., take-off weight 78,600 lb., take-off distance 4,650 ft. According to a Hawker Siddeley spokesman, the project has been put up to see if there is any official interest. There is, however, no question of producing the 750 as a private venture.

● **De Havilland** is now working on a new development of the *Comet 4*, with increased range and capacity. It is understood that this new version will be known as the *Comet 5*, and it will probably have non-stop trans-Atlantic range. The fuselage would be further stretched, and the wing modified. Engines of higher power would be used, probably the uprated *Avon RA.25/9* of 13,000 lb. thrust.

CIBA (A.R.L.) Limited, of Duxford, Cambridge, recently celebrated its Silver Jubilee. Left to right are: Dr. H. B. Marshall, of CIBA Co. Inc., New York, Dr. R. Käppeli, Chairman of the Board of CIBA AG., Basle, R.F.G. Lea, Commercial Director of CIBA (A.R.L.), and Sir Arthur Vere Harvey, Chairman of the British CIBA companies.

● **The de Havilland D.H.123,** now in the advanced project stage, is a 28-to-30-seat high-wing monoplane of simple structure, powered by two 1,000 h.p. *Gnome* turboprops.

● **The new upward ejection seat** being installed in the Lockheed F-104 *Starfighter* is designated C-2 and incorporates a rocket-catapult device. The first aircraft with the new ejection system will be flight tested shortly. All USAF F-104s now in service, as well as those on the assembly line, will be equipped with the C-2 system. Full recovery (safe escape) is possible over a speed range from 100 knots to 550 knots and from ground level up to 50,000 ft.

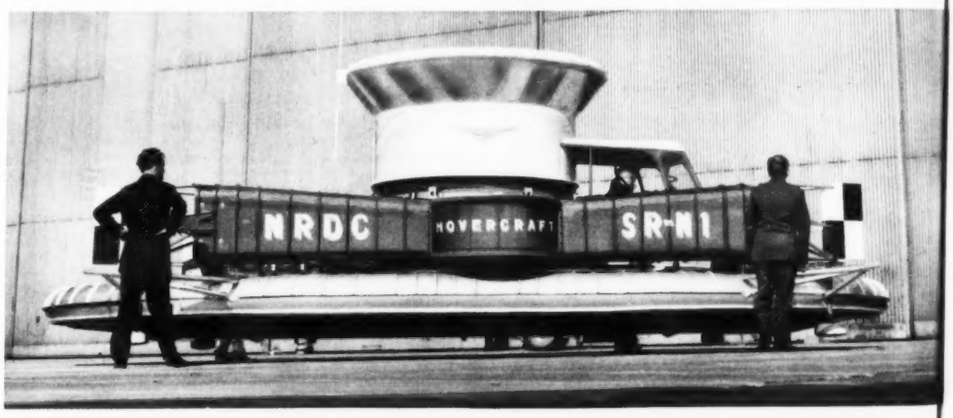
● **Japan's X1G2 experimental STOL aircraft** is due to begin flight testing shortly. The X1G2 is an advanced model of the X1G1, which in turn was derived from the Saab-91B *Safir* and was equipped with special high-lift devices.

● **FAA certification tests of the Boeing 707 Intercontinental** have been completed. A total of 379 flying hours was logged by the two Intercontinentals in the FAA programme, including 52 hours 30 minutes on long-range functional and reliability tests and the record-breaking Seattle-Rome non-stop flight on May 28th-29th.

● **The new all-weather F-105D version** of the Republic *Thunderchief* made its first flight on June 25th, 1959.

● **The U.S. Navy's two missiles,** *Corvus* (air-to-surface weapon which can also be used against enemy surface ships) and *Eagle* (long-range air-to-air missile) are undergoing evaluation trials at the U. S. Naval Missile Center, Point Mugu, California.

● **The PD-37 Pyrodyne** small ramjet engine has been announced by the Allison Division of General Motors.



The Saunders-Roe SR.N1 experimental hovercraft, powered by a 435 h.p. Alvis Leonides *piston engine with a ducted four-blade propeller to generate an air cushion and an airstream for forward propulsion.*

First international version of the Lockheed Electra *for KLM Royal Dutch Airlines. The range of this version is 3,500 miles, i.e. 750 miles longer than that in service on U.S. domestic routes, and it is known as the Model 188C. It has also been ordered by Tasman Empire Airways, Qantas Empire Airways and Garuda Indonesian Airways.*

The Canadair-Convair 540, powered by Napier Eland *propeller turbines, took off from England on a European demonstration tour at the end of June. Among the places at which the 540 was exhibited were Stockholm, Helsinki, Oslo, Zürich and Geneva. Also on the programme were demonstration flights in Spain, Portugal, the Federal Republic of Germany, Belgium and Austria.*

On June 5th, 1959, a plaque was unveiled on the main façade of the Fiat Works in Turin in memory of engineer Aristide Faccioli, whose triplane made its first flight fifty years ago. The commemorative speech was read by Professor Giuseppe Gabrielli, Director of Fiat-Aviazione. Second from the right is Senator Giovanni Bovetti, Under-Secretary of S ate to the Ministry of Defence, on his left Fiat Vice-President Dr. Gianni Agnelli.

It is designed for use on target drones launched by carrier aircraft. Thrust 60 lb at Mach 2 at 70,000 ft. Pyrophore propellant. The price is said to be less than $ 1,500 per unit.

● **Partenavia,** of Naples, is building a prototype of the Partenavia P.59, which is being entered in the contest for a standard sports aircraft for the Italian Aero Club. Based on a design by Engineer L. Pascale, of Naples University, the P. 59 is a strutted low-wing aircraft of mixed construction, with a fixed tail-wheel undercarriage, powered by a Continental C.90. Span 32.8 ft., length 21.6 ft., weight equipped 992 lb., gross weight 1,512 lb., max. speed 106 knots, cruising speed 98 knots, stalling speed with flaps 42 knots, take-off run fully loaded 468 ft., landing run 525 ft.

● **Italy's Costruzioni Aeronautiche Giovanni Agusta** has announced details of a new light helicopter, the Agusta 103 single-seater. A two-seat version, designated 103 B, is also planned. Both versions have a two-blade rotor 24.3 ft. in diameter and will be powered by a 80/85 h.p. M.V.GA-70 engine.

● **SOPEMEA's** Laboratoire Central Français pour les Equipements Aéronautiques has put into operation the most powerful vibration test equipment ever installed in Europe. Loads of 7,700 lb. can be applied over a frequency range of 5 to 2,000 c/s, to permit static testing of the behaviour of high-speed aircraft and missile parts under the effects of multiple vibration due to noise, the operation of jets, aerodynamic action, etc.

● **Thomson Houston and CSF** are producing a new small transmitter/receiver for use by parachutists. The equipment was used in a recent demonstration of communications between two parachutists in free fall. It weighs less than 6.6 lb. and offers great possibilities for training purposes.

● **The Cessna 210 touring aircraft** has received its FAA certification and been approved for production.

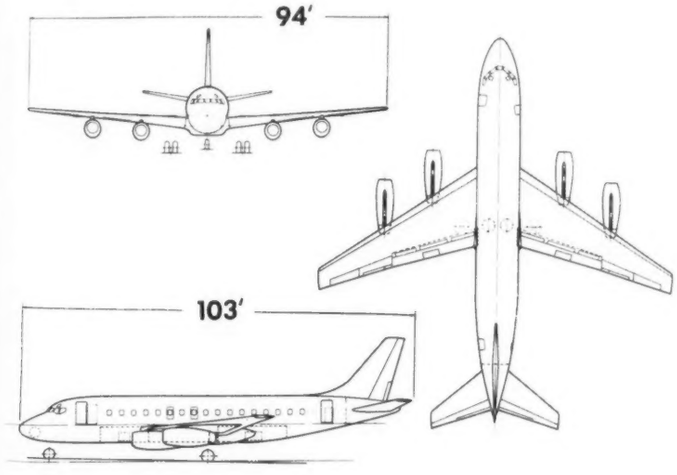
● **The de Havilland Comet 4's** maximum structural landing weight has been increased from 118,500 lb. to 120,000 lb. The same figure also applies to the *Comet 4B* and *4C*. Zero fuel weight of the *Comet 4* has been raised from 95,000 lb. to 99,000 lb., while the zero fuel weights of the *Comet 4B* and *4C* remain at 102,500 lb.

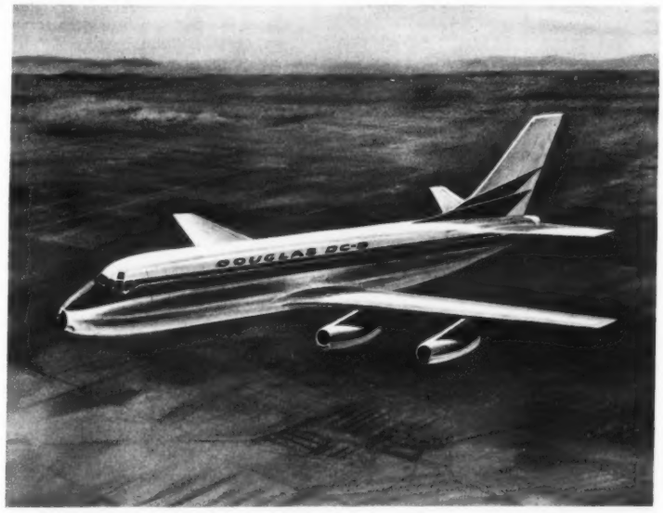
● **The Czechoslovak aircraft industry** will again be taking part in full strength in this year's Brno International Fair (September 6th to 20th). Main exhibits will be trainers, sports and touring aircraft, engines and propellers, aircraft instruments, airport equipment and a flight simulator. Specific items will include the Z.326 *Trener Master* two-seat trainer, quantity production of which is scheduled to begin in 1960. Omnipol (the State trading organization) will also be showing the *Meta-Sokol* with the new M.332 engine (140 h.p.) and the twin-engine *Aero 145* and L.200 *Morava*. The *Aero 145* differs from its predecessors, the *Aero 45* and *Super Aero*, in using the new M.332 engine. It will be ready for delivery before the end of the year. The L.200 *Morava* is being shown at Brno in its final export version, with 210 h.p. M.337 engines. Other exhibits will be the L.60 *Brigadyr* multi-purpose aircraft, the L.13 *Blanik* sailplane, the M.332 and M.337 engines and the V.410 and V.415 propellers.

● **The Ilyushin 11-18** four-turboprop commercial transport is reportedly being built in three versions: with cabin layout for 73 passengers, for 80 passengers and with high-density seating for 89 to 100 passengers.

On June 18th, 1959, test pilot Gérard Muselli of Générale Aéronautique Marcel Dassault set a new world record over a 100-km course in a Mirage III *powered by a SNECMA* Atar 9, *reaching an average speed of 1,095 m.p.h.*

The Douglas DC-9 medium range transport aircraft powered by four Pratt & Whitney JTFI 0A-1s, each with 8,250 lb of thrust. Flight crew of three to five plus cabin crew; 68 first-class passengers or up to 92 passengers in coach version; cruising speed over 500 knots; all-up weight 120,000 lb; payload 20,355 lb.





A batch of Borgward Focke Kolibri I *helicopters is in preparation (above). This model is to be powered by a 260 h.p. Lycoming VO-435-A1B engine.*

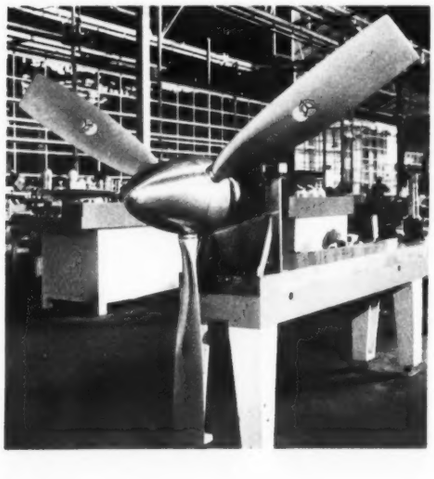
The Comet 4B *left the de Havilland airfield at Hatfield on its maiden flight on June 27th, 1959. Six* Comet 4Bs *are being built for British European Airways.*

The Beija Flor *two-seat helicopter (centre) originally developed under the direction of Professor H. Focke, which has been built and tested in flight at the Centro Técnico de Aeronáutica at São José dos Campos, Brazil. Engine: 225 h.p. Continental. Diameter of main rotor 29.5 ft.; all-up weight 2,094 lb; most economical cruising speed 70 knots; service ceiling 11,500 ft.; hovering ceiling with ground effect, 8,850 ft. or 4,593 ft. without ground effect.*

This Helitest *mass spectrometer is in quantity production at the Laboratoire des Basses Pressions at Argenteuil, France. Designed for use in laboratories and factories, the equipment can detect infinitesimal leaks (as small as 2×10^{-10} cm^3/sec) in pressurized air, water and fuel systems etc. — Laboratoire des Basses Pressions is also producing stainless steel pressure oil pumps and easily extendable screened heating units.*

The French works Etudes et Fabrications Aéronautiques (EFA), of Clichy, near Paris, specialists in the manufacture of parachutes for the dropping of men and supplies, have now introduced into their programme the production of the complete high altitude flying kit shown in the picture (type 12 helmet, pressure suit type 22A and pressure gloves). The kit will be delivered to the French Air Force for use by crews of the Dassault Mirage III *supersonic fighter.*

New helicopters: The Italian firm Costruzioni Aeronautiche Giovanni Agusta is working on the Z.101G helicopter (see drawing above), which will be powered by three de Havilland Gnome *turboshaft engines, each of 1000 h.p.*



Among the products of the French Ratier-Figeac works are two propellers for use with Turboméca turbines. Shown in picture is the F.H.76, which is at present undergoing acceptance tests. This model is to be used with the Turboméca Astazou *propeller turbine and is also currently being tested in flight. It is fitted with electrical pitch control, its weight is 121 lb and its diameter 6.25 ft. — The same manufacturer is producing the type F.H.86 propeller, so far the only propeller of French design to receive official approval for use with propeller turbines and fitted to the Turboméca* Bastan *on the SFERMA-*Beech-Bastan, *Morane-Saulnier MS. 1500* Epervier, *Dassault MD.415* Communauté *and Sud-Aviation SE.117* Voltigeur. *— The F.H.86 has hydraulic pitch control, its weight is 165 lb and its diameter 8.2 to 9.2 ft. depending on application.*

● **Kaman Aircraft Corporation** has begun a full-scale flight test programme for the new Navy HU2K utility helicopter. Production of the General Electric T58-powered helicopter is being phased in parallel to the flight development programme. This machine features a retractable undercarriage and a four-blade main rotor with Kaman servo-flap control system. Rotor diameter is given as 44 ft., max. length as 52 ft. 2 in., weight empty 5,050 lb., and gross weight 9,150 lb.

● **Goodyear Tire and Rubber Co.,** of Akron, Ohio, has developed a new pourable rubber-based material to shield crew and passengers in nuclear-powered aircraft and ships. The material can withstand temperatures ranging from —60°F to +200°F.

● **Morane-Saulnier** has announced new figures for its MS.1500 *Epervier* two-seat police and low-level strike aircraft. Main dimensions now are: span 42.9 ft., length 34.7 ft., wing area 261.6 sq. ft., gross weight approx. 6,170 lb. including armament, max. speed 178 knots, stalling speed 49 knots. The MS.1500 can carry a selection of the following armament: four 7.5-mm machine guns or two 20-mm cannon, rockets, bombs or four Nord SS.11 missiles.

● **The U.S. Navy** has selected *Phantom II* as the name for the McDonnell F4H-1 all-weather interceptor, now in production. The original *Phantom* was the FH-1, the Navy's first operational jet fighter, which joined the fleet in May 1948.

● **The Folland Gnat** has now passed all its service trials and has been accepted by the Indian Air Force for squadron service. An official production order has been placed with Hindustan Aircraft (Private) Ltd. at Bangalore, and the aircraft will now be put into full production; the number of *Gnats* ordered has not been disclosed.

● **Japan's Fuji Heavy Industries** expects to receive a Defense Agency order for large-scale production of the T1F2 jet trainer within the very near future. The Air Self Defense Force's Flight Test Group is currently evaluating the first six prototypes for the Research and Development Headquarters.

● **Etudes et Fabrications Aéronautiques,** of Clichy, France, has received an order from the Pioneer Parachute Company Inc., of Manchester, Conn., to supply 50 of the new EFA quick-release parachute harnesses for complete testing by the U.S. Army.

● **The Skyphone airborne telephone system** developed by AC Spark Plug Division of General Motors enables telephone calls to be made and received from an aircraft flying within 150 miles of a suitable ground station. The VHF transmitter/receiver operates in the range 450 to 470 Mc/s, and background noise and interference is eliminated by use of frequency modulation. A selective call system enables a ground station to call a particular aircraft. Weight of the installation is 37 lb.

On the occasion of the Paris International Air Show a special stamp was issued in memory of test pilots Goujon and Rozanoff, who met their deaths in flying accidents.

Book Reviews

Taschenbuch des Motorfliegers. — Edited by Georg Brütting and eleven colleagues. — Franck'sche Verlagshandlung, W. Keller & Co., Stuttgart, 1959 (German; 486 pages; 378 illustrations in the text and 32 aircraft photos; subject index; pocket format; plastic cover; price DM 29.50).

Prepared by well-known experts, this pocketbook presents an introduction into the theory of flight and all details of aeronautical engineering of interest to the powered aircraft pilot, also chapters on air law, air traffic control, radio communications, meteorology, navigation and training regulations. This book is a must for students of German mother tongue who are preparing to take their private pilot's licence, and recommendable for experienced pilots desirous of brushing up their knowledge. The instructions it gives for smooth flight operations are particularly valuable. Wz.

Regards neufs sur l'Aviation Commerciale. — By Henry Laile. — "Peuple et Culture" series, Editions du Seuil, Paris, 1959 (French ; 303 pages).

The author takes the layman gently but firmly by the hand and introduces him to the realm of air transport : international organizations, airports, airline fleets, passenger, mail and freight transport, ocean, polar and domestic services ... an amazing variety of knowledge is here imparted in a conversational tone and enlivened by well-chosen episodes, cartoons and photographs. Brigitte Bardot smiles at the reader from the aircraft steps, panthers, gorillas, Marilyn Monroe, Dior models, "Uncle" Jacques Tati ... all go by air. This charming little pocketbook can be recommended with a good conscience. He.

Hyperstatic Structures — Vol. I. By J.A.L. Matheson. With Chapters by N. W. Murray and R. K. Livesley. Published by Butterworths Scientific Publications, London, 1959 (English; 474 pages; illustrations; price 90 shillings).

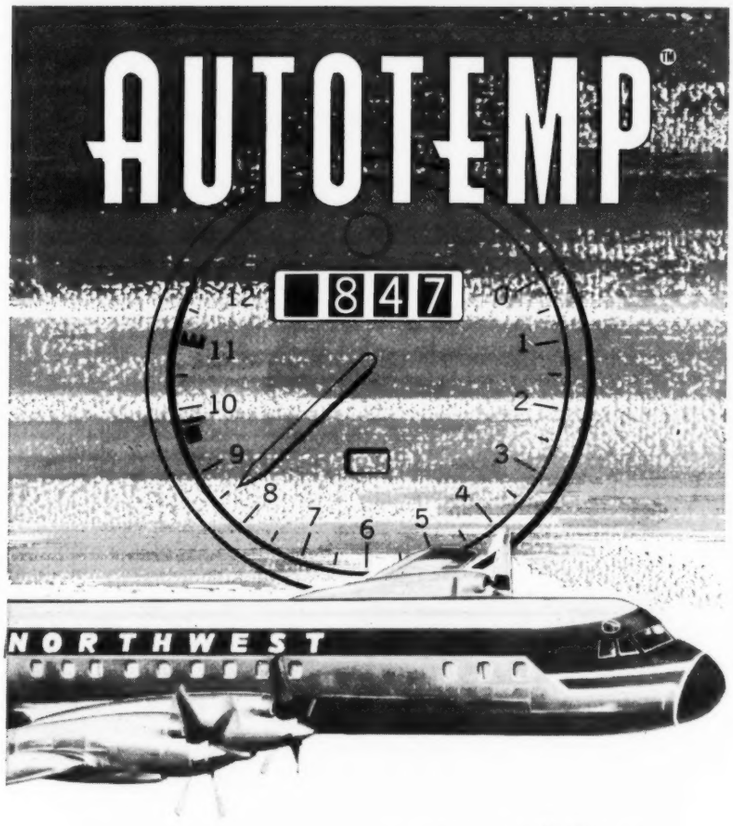
A structure is said to be hyperstatic when it incorporates more members, or is supported by more reactive restraints, than would be necessary to achieve stability. Unfortunately, as structural designs have become more complicated, so have the theorems and solutions for hyperstatic problems multiplied, with the result that the student is now faced with a formidable array of apparently unrelated theoretical analysis. This book clarifies the situation by establishing a well-defined "family tree" of theorems, explaining the evolution of each theoretical calculation, and the common relationships existing throughout. Complicated structures can now be analysed on computers and the interesting chapter by Dr. R. K. Livesley deals briefly with the relevant parts of matrix theory, and describes the principles applied in developing computer programmes for structural calculations. Pe.

Taschenbuch für Wehrfragen 1959. — Edited by Hans Edgar Jahn and Kurt Neher, in conjunction with the Federal German Defence Ministry. — Festland Verlag, Bonn, 1959 (German; 560 pages thin paper; 18 colour plates and 200 other illustrations; pocket format; index of subjects, place names and personalities; plastic cover; price DM 21.00).

The third edition, just published, of this pocket book on the German armed services retains the make-up of earlier editions and is once again up-to-date, reliable and concise. Contents have been considerably expanded, and the new edition describes the development of the Bundeswehr up to the beginning of 1959, explains the political and defence considerations on which it is based, sets out its main divisions (Army, Air Force, Navy, Territorial Defence), and finally discusses its organization and tasks. The book has been enlarged through the addition of more than 200 illustrations of the basic types of weapons, aircraft, ships and vehicles in service with the Bundeswehr, and a new section containing portraits and biographical details of 42 of the leading personalities has been included. Wz.

Deutsche Luftfahrt-Gesetzgebung. — Edited by Wegerdt-Reuss, 3rd Edition, corrected to March 1st, 1959. Südwestdeutsche Verlagsanstalt, Mannheim, 1959 (German; 449 pages; price DM 17.80).

The collection of the texts of German air laws prepared by the late Alfred Wegerdt, the first two post-war editions of which (1952 and 1955) were reviewed in detail in *Interavia*, has now been revised and enlarged by Wegerdt's pupil, the Munich air law expert K.-F. Reuss. It is hard to imagine a more concise and conscientious presentation of such complex matter. Wegerdt has found a worthy successor. He.



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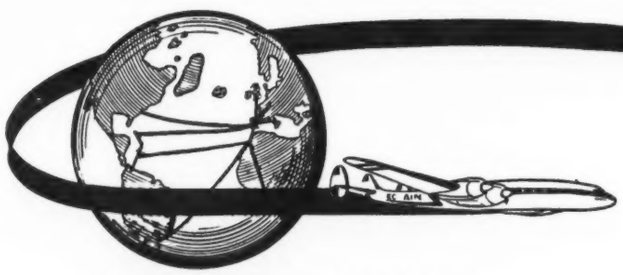

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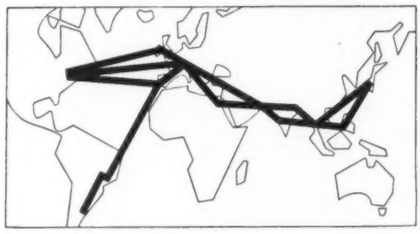

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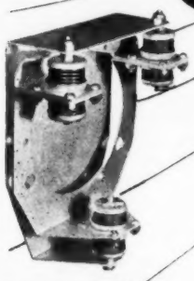

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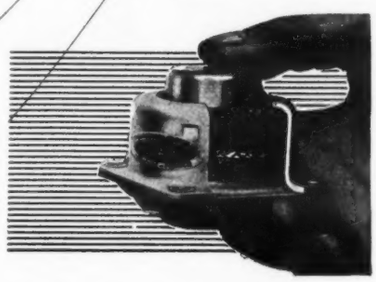

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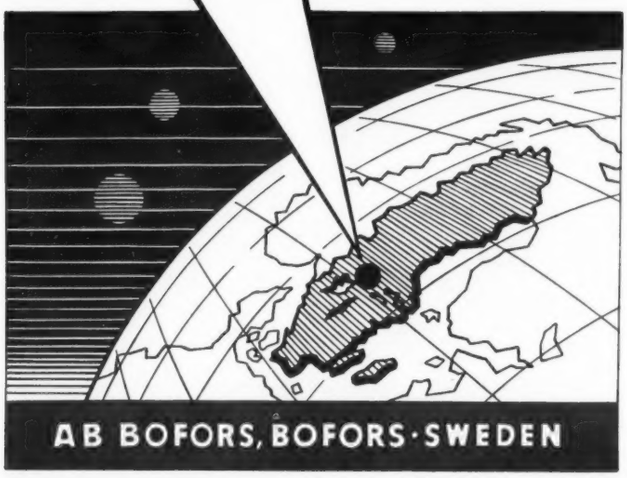

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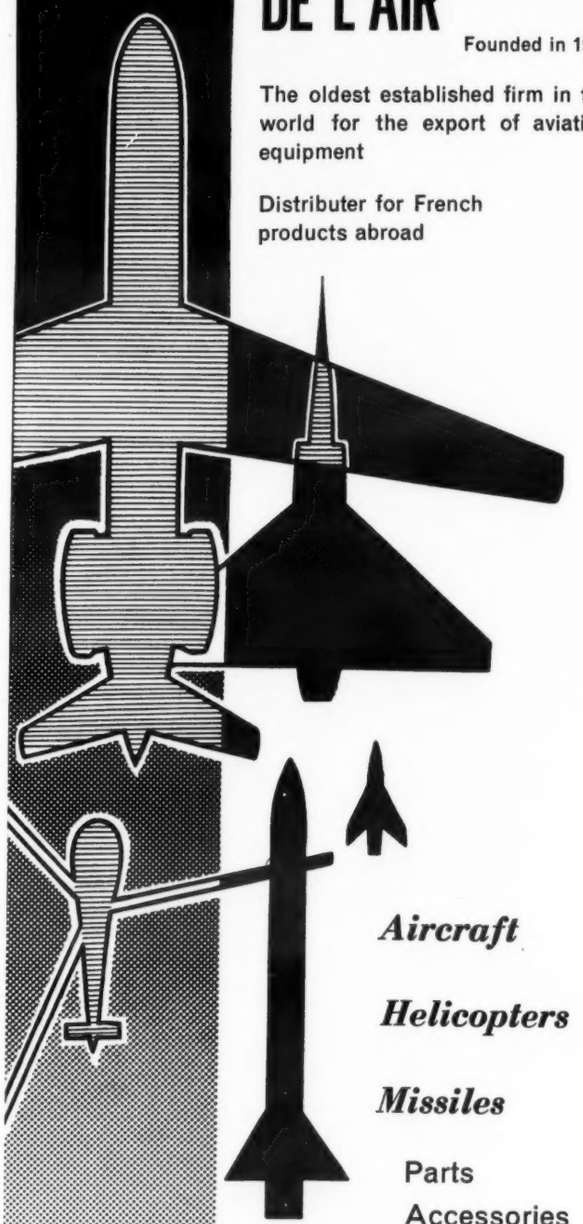

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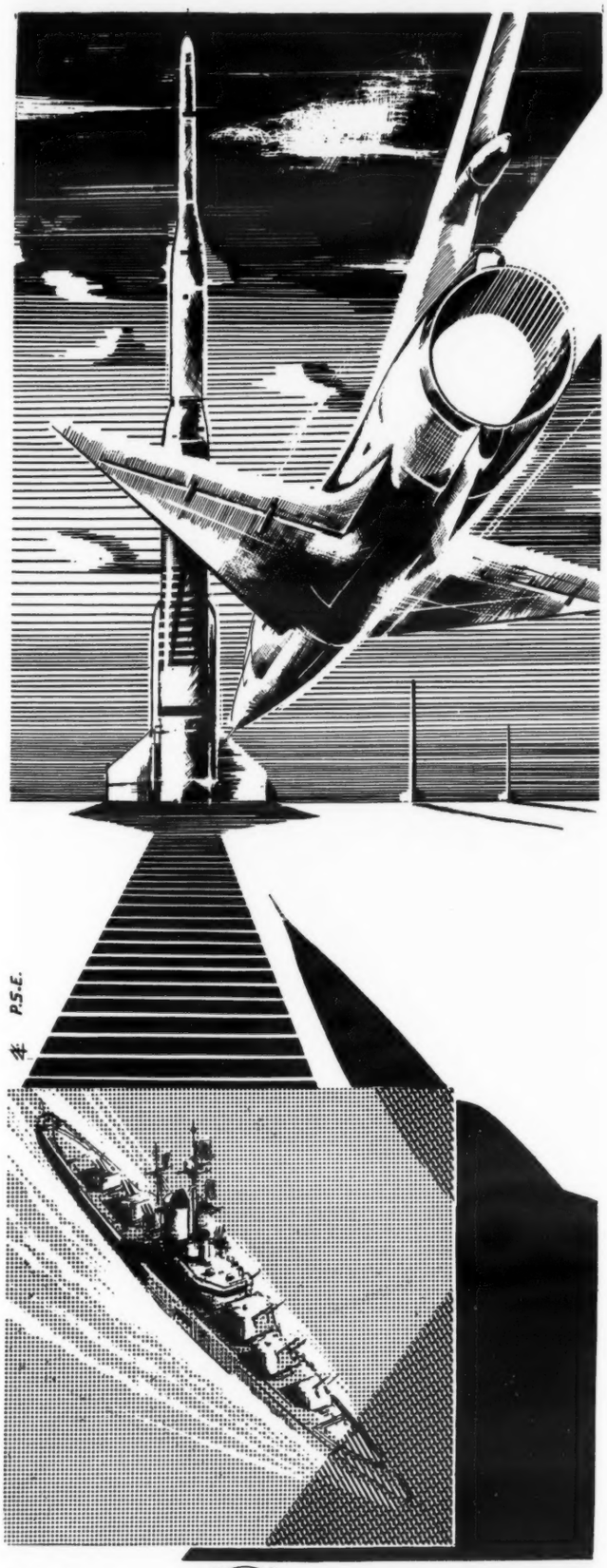

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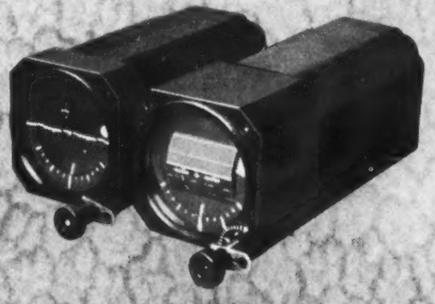

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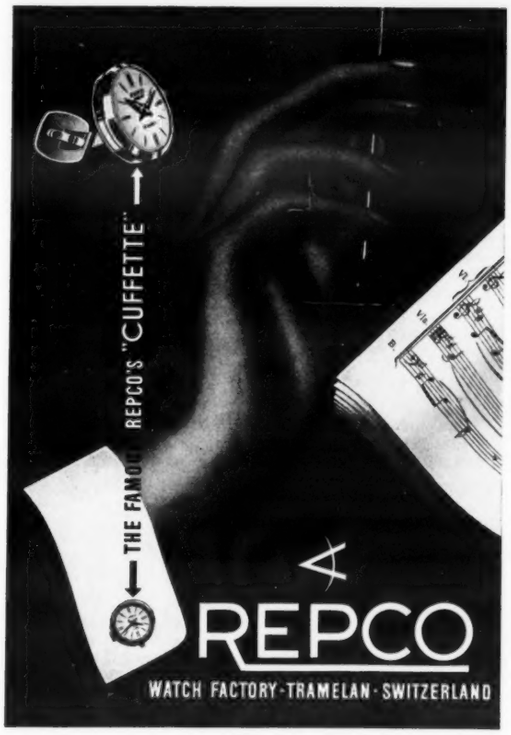

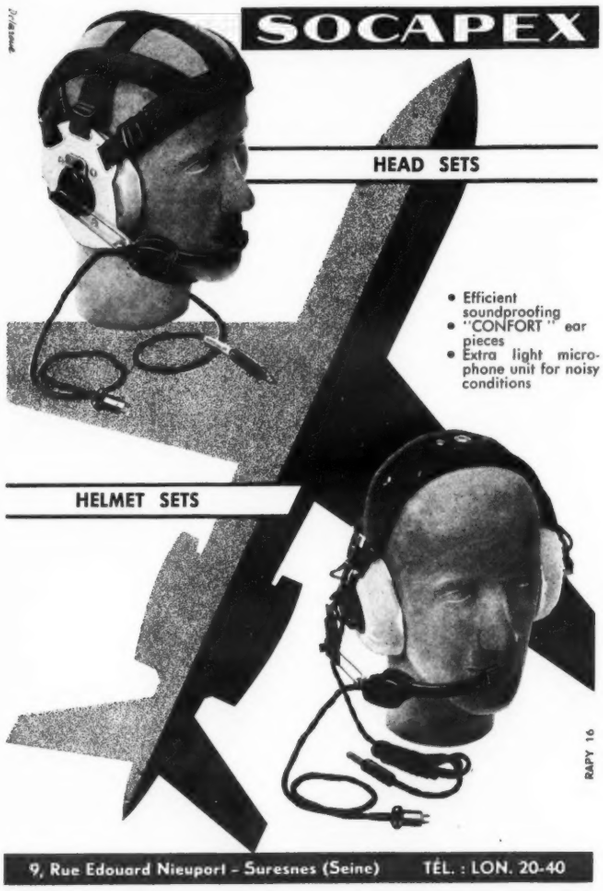
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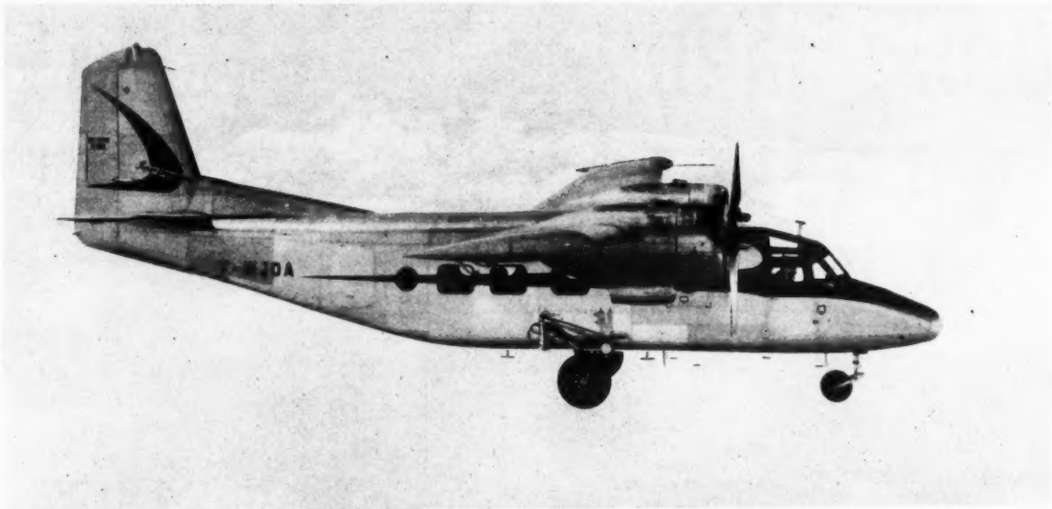

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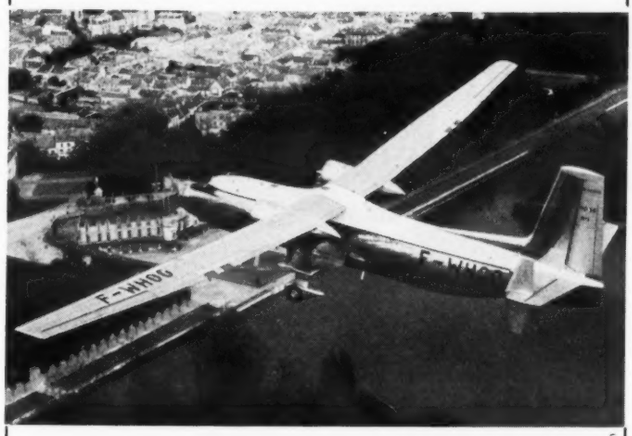

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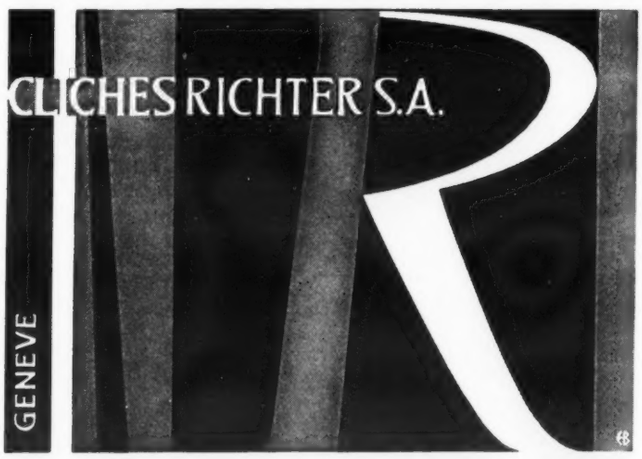

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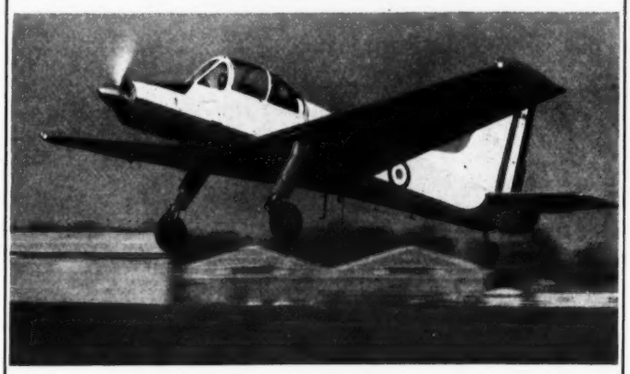

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